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THROUGH-VISIBILITY IN BRIDGE HANDRAIL DESIGN

Esthetic, Recreational, and Artistic Value Quite as Important as Utilitarian Value

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The article entitled "Vistas—Why Not Open Up Bridge Handrails?", published in the June issue of ROADS AND STREETS, *was an exposition of the "Why" on this subject. This article will attempt to present a partial "How" of streamlined, open style railing design, using malleable iron style creation and variety.*

The word "streamlined" is an admittedly overworked expression, and its association with subject is explained.

STREAMLINING can imply, of course, different visual things in different fields. With fast-moving vehicles, it may connote, to the man in the street at least, the use of gentle curves and flowing horizontal lines, apparently to control the path of the disturbed atmosphere. In floating river equipment such as steel barges, for example, it may mean the design of sharply sloping rake ends to reduce water resistance to towing. For a bascule bridge, it may require the use of light, open mesh flooring to reduce both dead weight and wind load upon lifting.

As these diverse examples indicate, it should mean the refinement of design along fundamental channels. Can this be accomplished by merely "prettying up," or through the use of unnecessary "doodads"? Hardly, since streamlining, like enduring beauty, is built from within. And it embraces the employment of modern ingenuity and facilities to produce definite-purpose products, shorn of useless weight or non-essentials.

In the light of this reasoning, immovable objects may qualify for this descriptive term, and the first essential for streamlined railing is the provision for maximum through-visibility so that users may be given the impression of curtain-like delicacy and afforded the opportunity to enjoy the vistas of surrounding landscape.

Such through-visibility, it is found on examination, is the function of the relationship between relative size and frequency of member intersections or joints. Horizontal members impede vision and must be subordinated in space to the sizes needed for the required strength. For the same reason, joints must be sparing in size, and criss-cross patterns must be either avoided or very deftly executed.

Adherence to these rules aided by the use of delicately lined vertical balusters framed within the horizontal members, not only results in the provision for this desired through-visibility but distinctly impresses it on the consciousness of users. Conversely, the sensation of bulk or mass is avoided, and there is none of the feeling of obstruction produced by solid walls or complex structures with many cross members.

The strength requirements and safety functions of a bridge handrail must, it is manifest, receive primary consideration but can be treated only sketchily here. Pedestrian handrailing is not designed to safeguard vehicular traffic, this function being increasingly transmitted to special hub rails or curb guards in modern structures. Unless hub rails are 18 to 22 in. high, vehicles are liable to jump the curb. Consequently, bridge handrails should be made strong enough to insure holding at about one-half the original impact. Records of some thirty-one accidents over a period of years, involving impact against malleable iron railing from motor vehicles, in some cases from trucks, without a crash-through indicates that only the abnormal impact causes complete railing failure. Fig. 2 illustrates the result

Fig. 1.—The Main Span of the McKees Rocks Bridge Across the Ohio River, Near Pittsburgh, Pa. Over a Mile in Length, It Is One of the Largest Bridges in Pennsylvania. It Was Built in 1931; Has 4 Traffic Lanes and 2 Sidewalks Protected by Metal Hub Rail; Has Y Approach and 4 Ramps on the McKees Rocks Side or West End, and a Traffic Circle Connecting It to Ohio River Boulevard, Pittsburgh, on East End of the Bridge. The Handrail, Made of Malleable Iron and Steel, Has High Visibility.

of an accident in which a bridge railing was hit by a passenger car.

In view of anchorage limitations, and the practical difficulties of overcoming such limitations, it is folly to overplay the weight and strength of supporting vertical posts. A simple and inexpensive method of reinforcing railing structures is to connect the horizontal supporting members. This results in distribution of impact loads over a continuous rail and through a number of vertical posts and panels, and is a streamlined manner of securing strength with a minimum of weight or material.

Fig. 2.—Closeup of a bridge railing which was hit by a passenger car. It is highly ornamental malleable iron but the design is on the complex side, and recent creations have greater simplicity and through-visibility.

The final requirement in a protection sense is sufficient network of metal, without too greatly impairing visibility, to prevent hazards to pedestrians, such as the loss of packages or the wedging of a child's head in the railing. Here again, a material which lends itself to fine lines and delicate patterns is an advantage.

In any analysis of this subject, it is only proper to recognize that the acme in through-visibility and in simplicity of line is possessed by a straight picket fence. Fig. 3 illustrates this type of railing in which malleable posts are used for the main supports. On the other hand, plainness should not be an objective, and such railing would be inappropriate for most of the bridge engineering triumphs of our day, both in architectural caliber and design style.

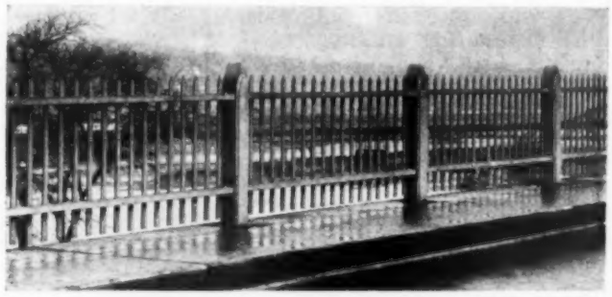


Fig. 3.—A plain picket fence type of handrail provides maximum through-visibility.

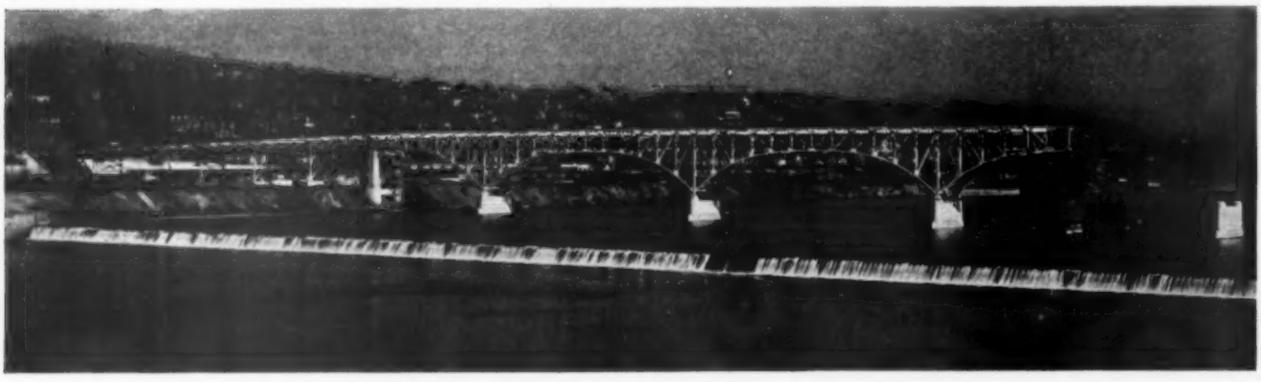


Fig. 4.—The New $2,500,000 Highland Park Bridge Being Built Across the Allegheny River Near Pittsburgh. Malleable Iron Railing, Similar to That Used on the Pittsburgh-Homestead High Level Bridge, Will Be Installed. It Is Shown in the Next Picture.

The trim arches and sweeping trusses of many modern bridges have stimulated the complemental development of railing panels with gently curved lines, which suggest that the motif of the bridge proper has been reproduced in miniature. Bridges are on display before the public just as any commodity, and, lest we forget our sales psychology which is just as important in bridge construction as in other fields of public consumption,

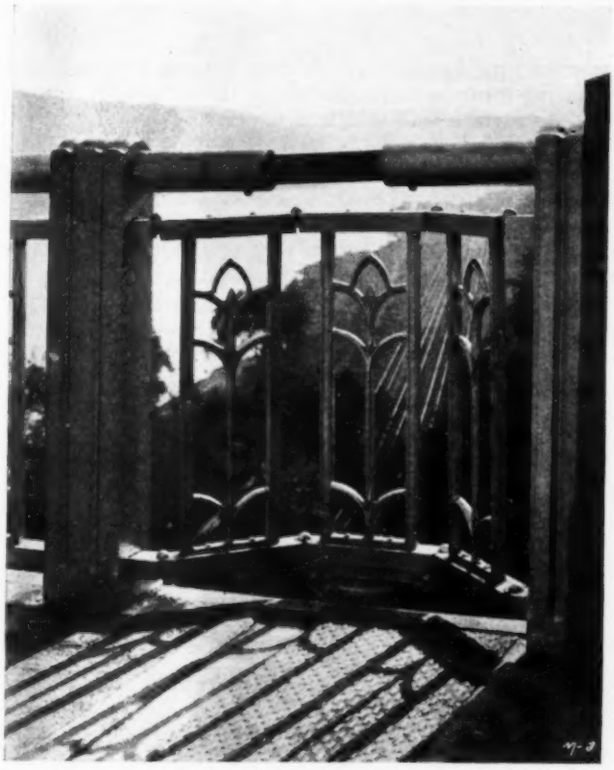


Fig. 5.—Closeup of One of the Railing Expansion Joints on the Pittsburgh-Homestead High Level Bridge. It Is a Novel Type of Expansion Joint, and the Picture Clearly Shows the Individual Malleable Iron Balusters, the Open Style Railing and Through-Visibility.

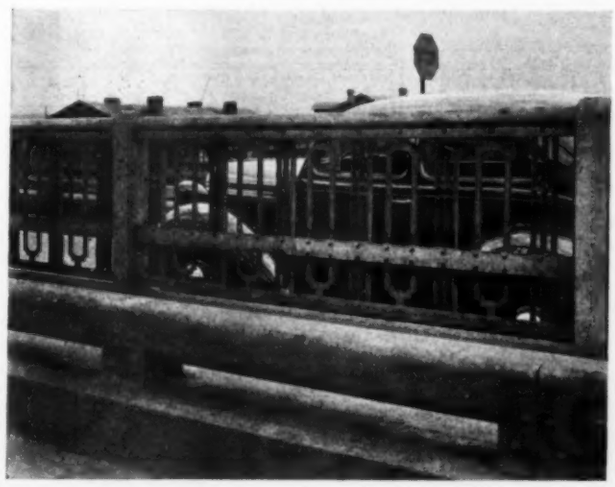


Fig. 6.—Showing Value of Through-Visibility Where Ramps Enter a Bridge Roadway. Also Note the Metal Hub Rail Added for Pedestrian Protection.

should be designed to possess not only utilitarian value but also esthetic, recreational, and artistic value.

The new $2,500,000 Highland Park Bridge, Fig. 4, now under construction across the Allegheny River, will provide an example of railing design which gives this impression. In addition to this harmony of theme, the malleable iron balusters have a Modern-Gothic note.

In considering installation routine, the development of these malleable iron railing designs has been accompanied by a reduction in the costs of assembly. The design used on the Pittsburgh-Homestead high level bridge, also selected for the Highland Park bridge near Pittsburgh, Pa., requires an assembly cost of about 10 per cent of the total railing expenditure.

As a final thought in this consideration of railing character, streamlined, open style handrails have arrived. The degree of streamlining and the style desired for a given structure must be determined with care, since requirements and motifs will vary, dependent not only on the factors noted but on external influences such as the historical significance of a structure or a spanned territory. There is, however, the presence of suitable materials, production flexibility, and design ingenuity which gives assurance that a suitable railing can be developed to meet any purpose, and it can be a made-to-order accessory which not only has an appeal of its own but reflects the beauty of the bridge and its surroundings.

TREND IN ROAD WIDTHS

Greater surfaced width of roads is of equal importance. There has always been the pressure to stretch highway funds beyond their limit to improve as many miles as possible. Surfaced width has been sacrificed for surfaced length. First 12- and 14-ft. road surfaces were built, then widths were increased to 16 ft., and later to 18 ft., and for some years 20 ft. has been the standard width for two-lane roads. The Federal Highway Act of 1921 demanded no greater width than 18 ft. Many of the older roads have been widened to this standard, generally as a part of a resurfacing operation. Here the wisdom of the stage-construction policy has been conspicuously demonstrated. The initial surfacing has caused a flow of traffic on the road with a corresponding flow of motor revenues for highways that is being used, in considerable part to remedy inadequate conditions. While many roads have been widened there is still much of this work to be done. The cost per mile of such work is not great unless it is accompanied by other improvements.

Within the last few years there has been a pronounced and desirable trend toward surfacing two-lane highways to widths greater than 20 ft. to accommodate the greater volume of traffic moving at higher speeds. While many new surfaces are now being constructed 22 ft. wide, a surfaced width of 24 ft. will soon come to be generally recognized as a desirable standard for important two-lane highways.—From the annual report of Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads.

NO MONDAY APPOINTMENTS FOR OHIO HIGHWAY OFFICIALS

Robert S. Beightler, the new director of the Department of Highways of Ohio, has issued the following order:

It has been determined that it is to the best interest of the public and to the proper administration of this department that certain officials have some time to devote to departmental business without interruption, therefore, commencing Monday, January 16, 1939, and continuing each Monday thereafter until further notice, the Director, Assistant Director and Chief Engineers of the Maintenance, Location and Design, Bridges and Construction Bureaus, will not make appointments except in cases of emergency or extreme necessity.

It is hoped that this will also benefit representatives of the many interests that call on this department regularly, and that they will not be kept waiting longer than is absolutely necessary.

AIRPORT RUNWAY CROSS-SECTIONS AND THE TRENDS IN DESIGN

IMPORTANT as is the designing and surfacing of runways, airport development includes other activities such as grading, drainage (of utmost importance), lighting for illumination, signaling, also hangars and other buildings. This article presents only some cross-sections of runways on several fields with short descriptions of the type of construction. This material was prepared by W. R. Macatee, District Engineer, The Asphalt Institute, Cincinnati, Ohio. It is based upon personal observation and upon questionnaire letters. The most pronounced trend in surfacing as revealed by drawings and letters received by Mr. Macatee was that toward lighter and less expensive surfaces. Almost unanimously, engineers agreed that the heretofore accepted idea that heavy bases and wearing surfaces at airports were required was fallacious and unnecessarily expensive.

Surfacing cross-sectional design is growing through experience—the hard way. Obviously, no fixed thickness of runway base and surfacing can be dogmatically prescribed for the reason that strength of subgrades vary so sharply in different localities due to varying soil and moisture conditions. Therefore, as in highway construction, the requirement is that the runway base and surfacing must be in proportion to the subgrade strength and the surface load which is expected.

The following diagrams were taken from Mr. Macatee's excellent presentation of airport landing fields in a booklet entitled "Trends in Construction of Runways and Other Airport Surfaces." A summary of these trends as brought out in the replies to his questionnaire from many sources follows:

1. Toward lighter, less expensive forms of surfacing.
2. Toward utilizing local materials more extensively.
3. Toward more extensive use of flexible forms of surfaces and bases.
4. Toward thicker film thicknesses of asphalt surrounding aggregate particles.
5. Toward the use of softer asphalts.
6. Toward greater use of liquid asphalts, such as MC and RC groups.
7. Toward more extensive use of asphalt stabilization of bases.
8. Toward constructing cut-off walls of asphalt mixtures at ends and sides of runways.
9. Toward having on hand fully developed and quickly available plans for future extension of runways and other airport facilities.

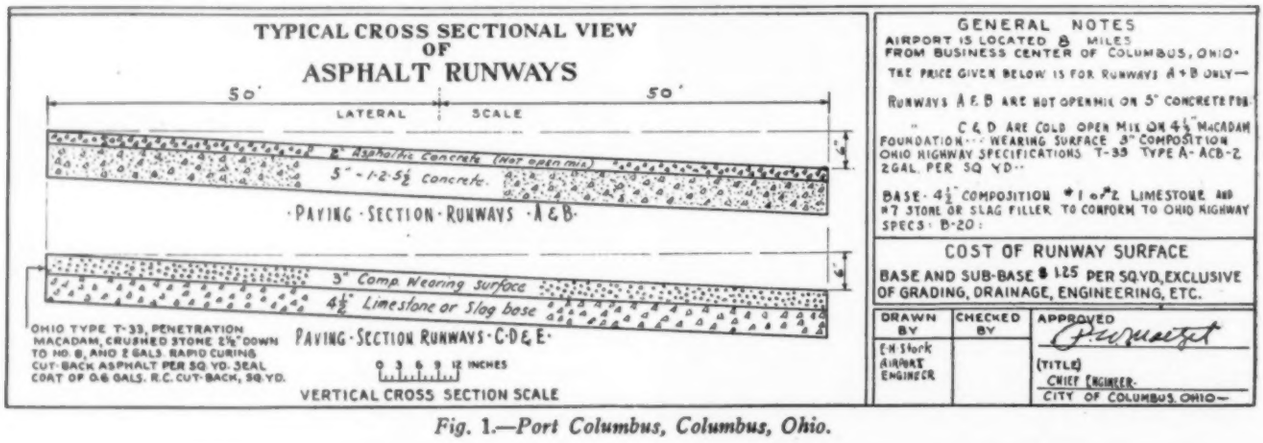


Fig. 1.—Port Columbus, Columbus, Ohio.

Fig. 2.—Reeves Field, Los Angeles Harbor, Calif.

AIRPORT RUNWAY CROSS-SECTIONS

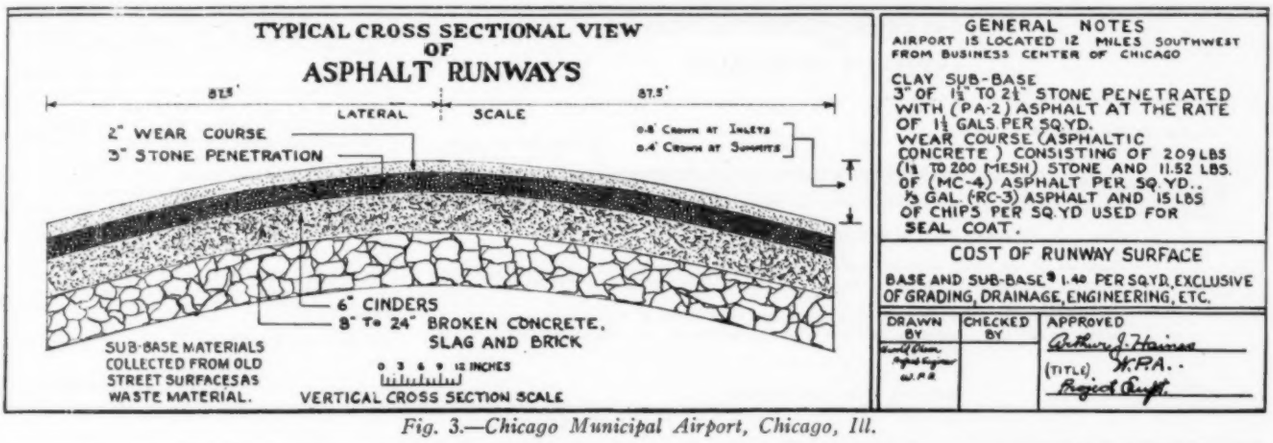


Fig. 3.—Chicago Municipal Airport, Chicago, Ill.

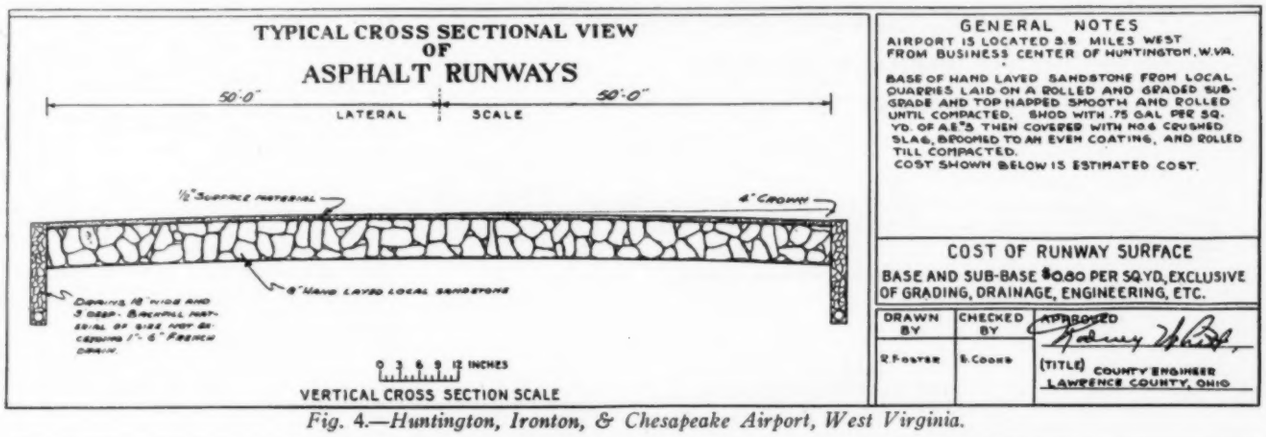


Fig. 4.—Huntington, Ironton, & Chesapeake Airport, West Virginia.

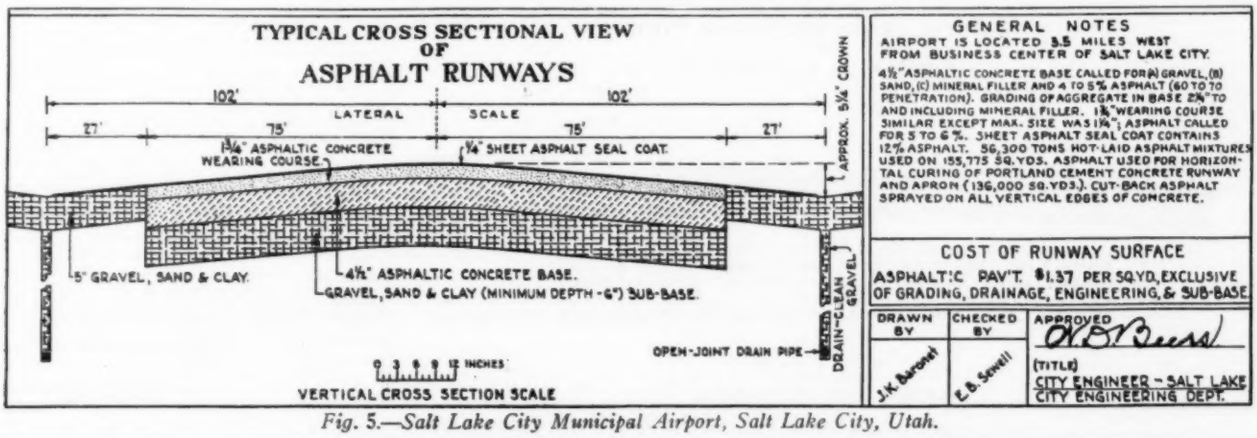


Fig. 5.—Salt Lake City Municipal Airport, Salt Lake City, Utah.

Fig. 6.—Chanute Municipal Airport, Chanute, Kansas.

AIRPORT RUNWAY CROSS-SECTIONS

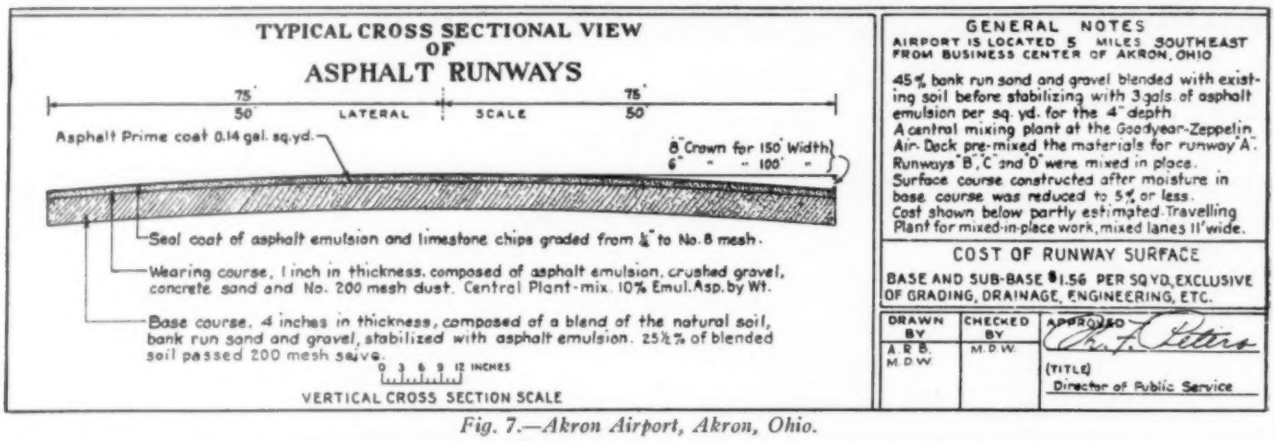


Fig. 7.—Akron Airport, Akron, Ohio.

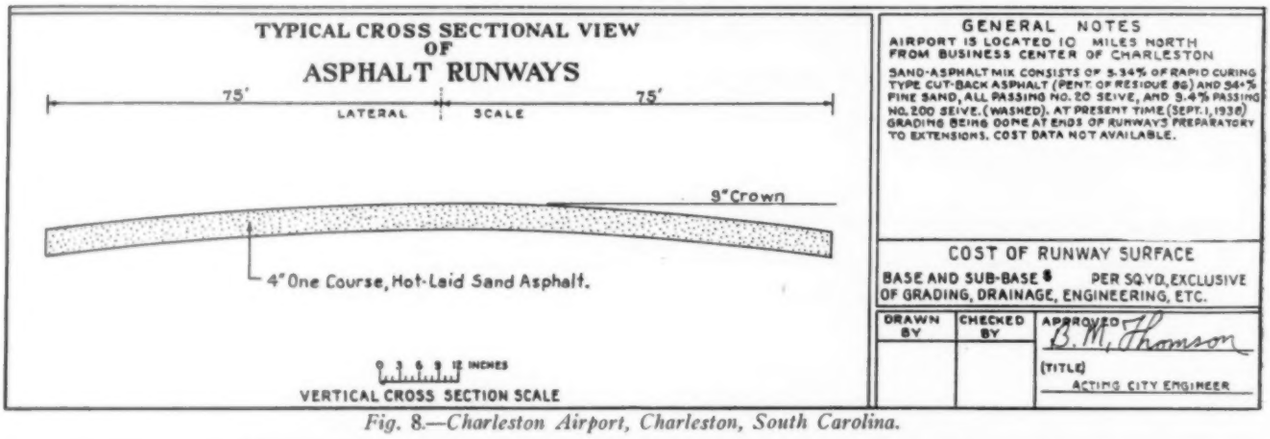


Fig. 8.—Charleston Airport, Charleston, South Carolina.

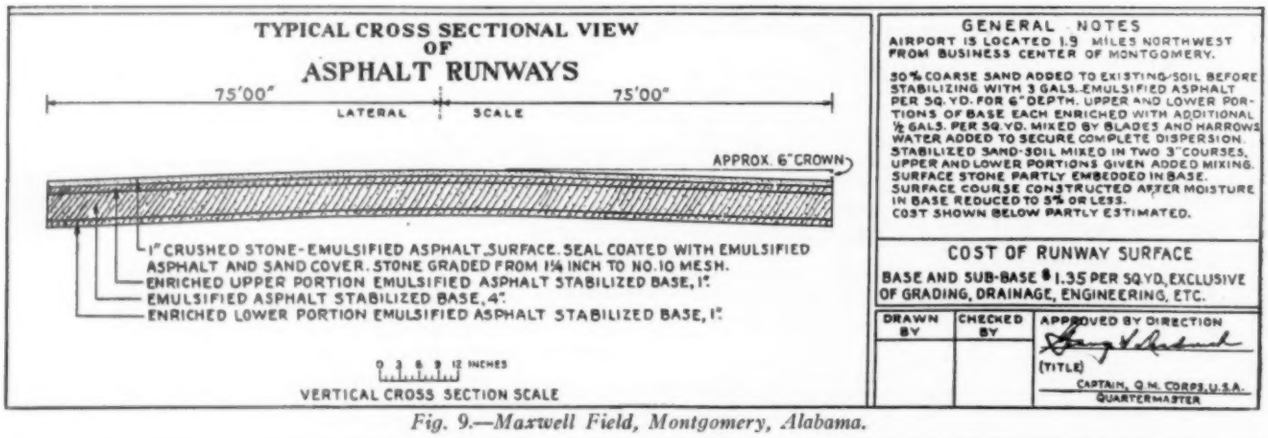


Fig. 9.—Maxwell Field, Montgomery, Alabama.

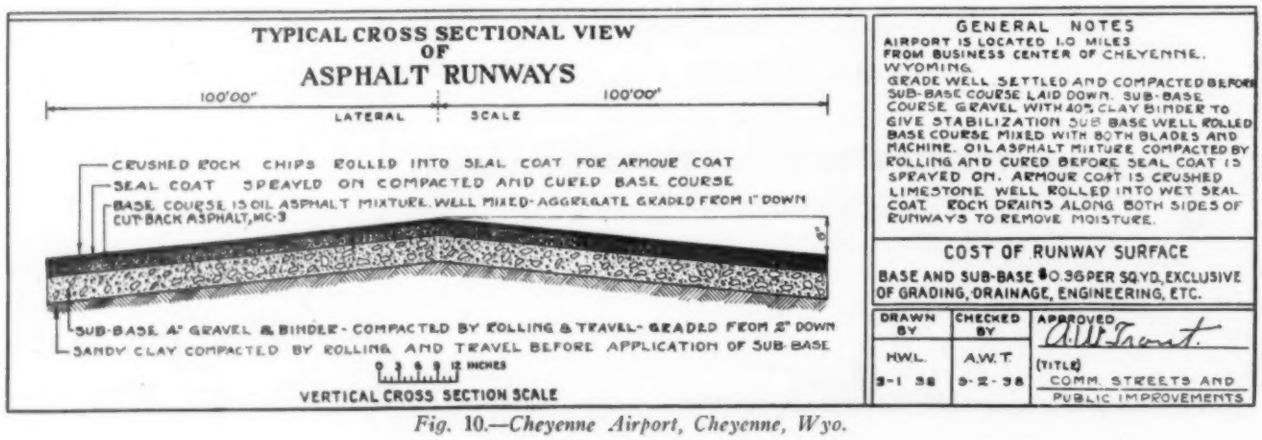


Fig. 10.—Cheyenne Airport, Cheyenne, Wyo.

AIRPORT RUNWAY CROSS-SECTIONS

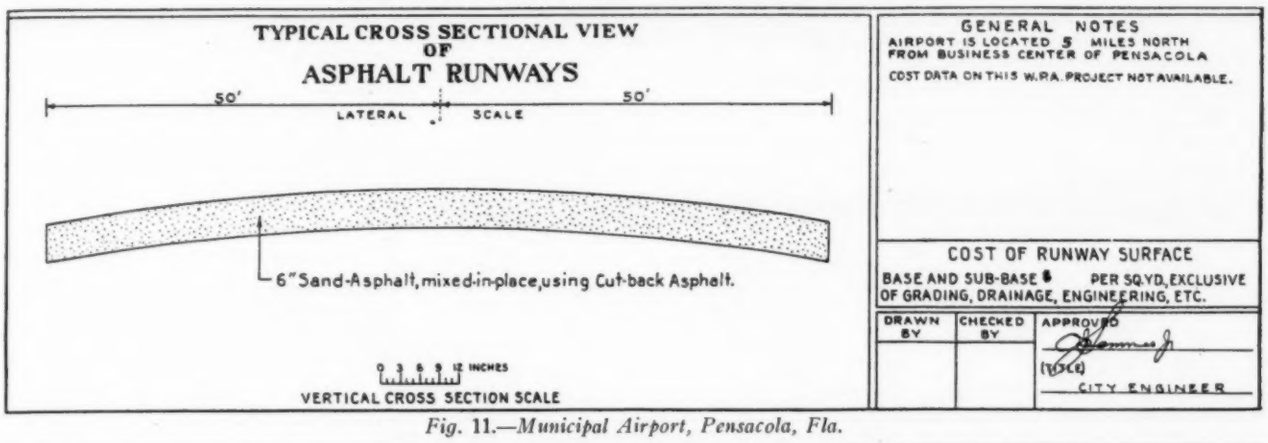


Fig. 11.—Municipal Airport, Pensacola, Fla.

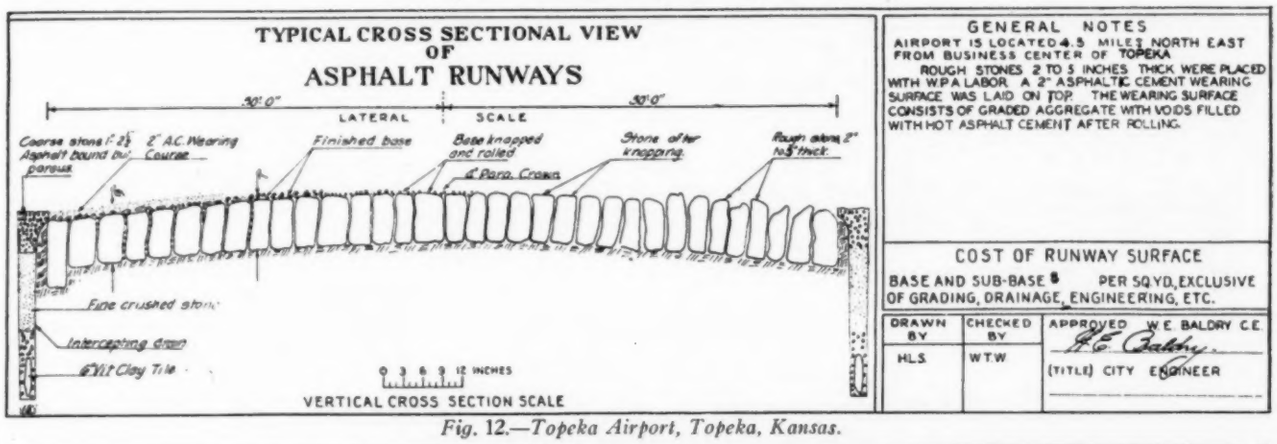


Fig. 12.—Topeka Airport, Topeka, Kansas.

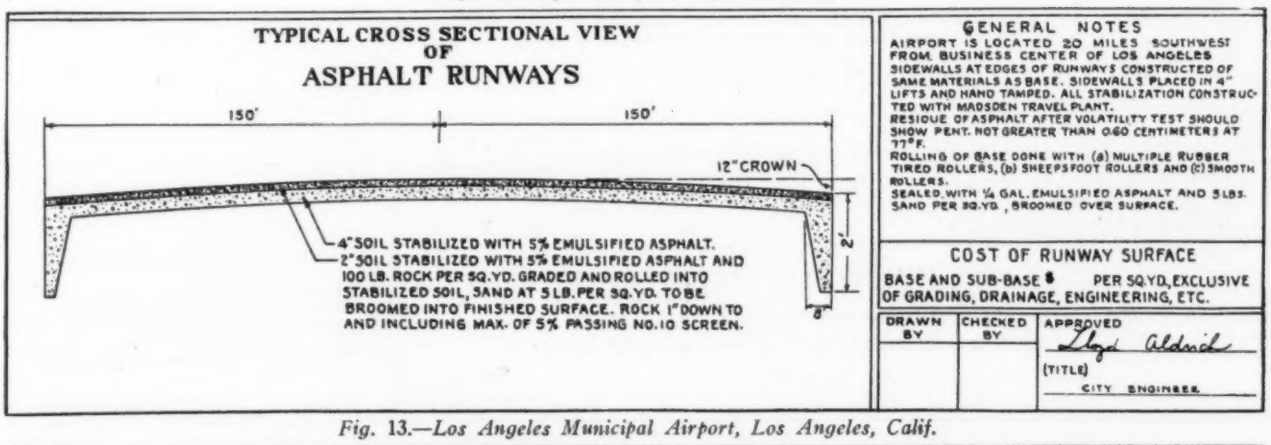


Fig. 13.—Los Angeles Municipal Airport, Los Angeles, Calif.

Fig. 14.—Kell Field, Wichita Falls, Texas.

AIRPORT RUNWAY CROSS-SECTIONS

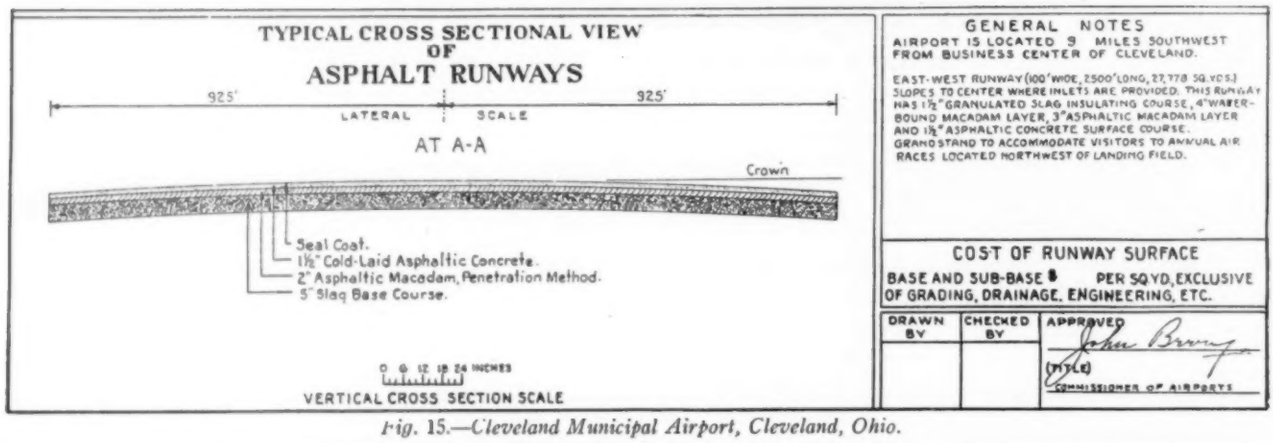


Fig. 15.—Cleveland Municipal Airport, Cleveland, Ohio.

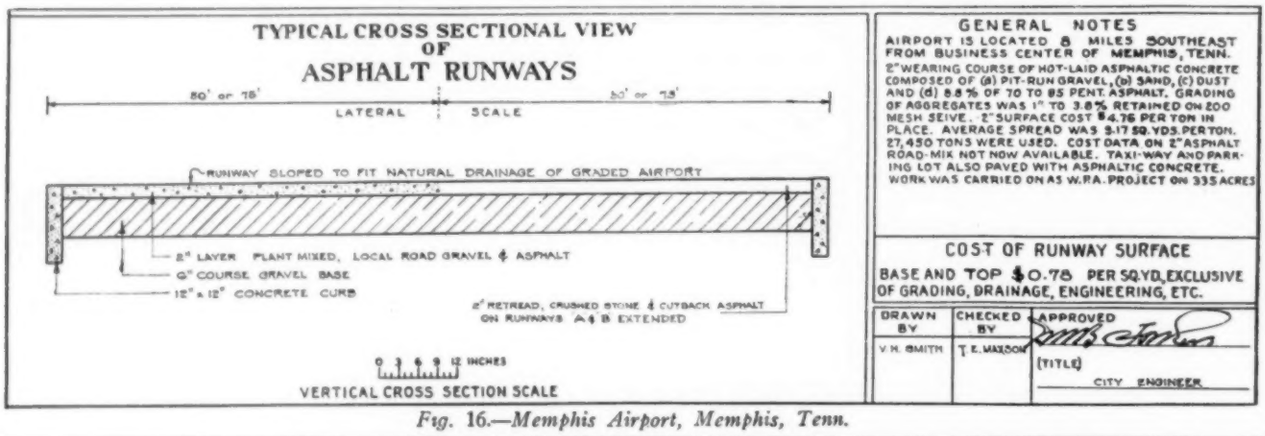


Fig. 16.—Memphis Airport, Memphis, Tenn.

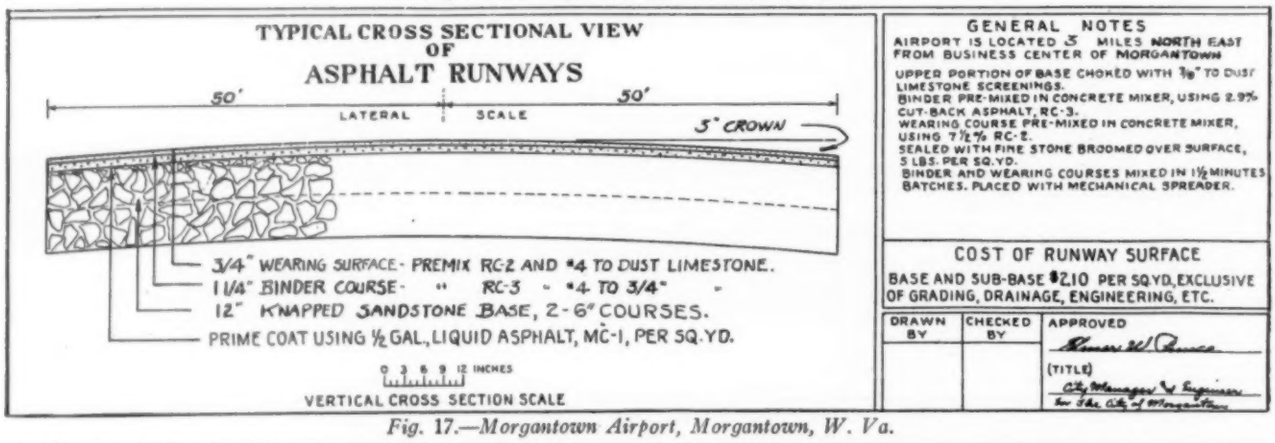


Fig. 17.—Morgantown Airport, Morgantown, W. Va.

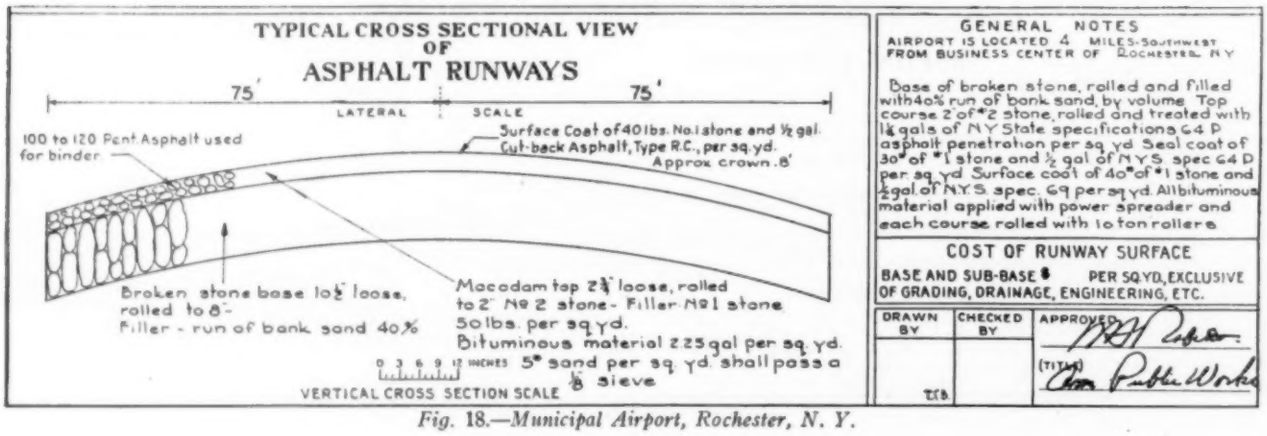
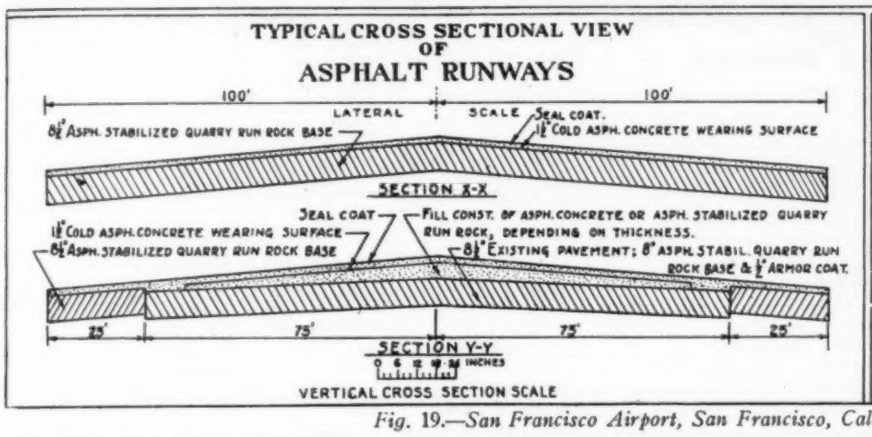


Fig. 18.—Municipal Airport, Rochester, N. Y.

AIRPORT RUNWAY CROSS-SECTIONS



GENERAL NOTES

AIRPORT IS LOCATED 12 MILES SOUTH FROM BUSINESS CENTER OF SAN FRANCISCO.

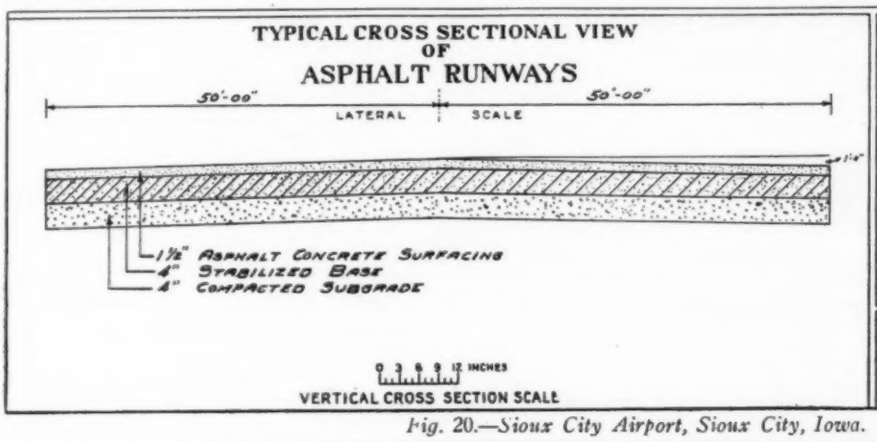
SEAL COAT; ½ GAL EMUL. ASPH. & 5# SAND PER SQ. YD.
WEARING SURFACE; 1½" OF CRUSHED ROCK MIXED WITH 7.5% TO 9.25% BY WT. OF EMUL. ASPH.
BASE; 8½" OF EMUL. ASPH. STABILIZED QUARRY RUN ROCK CONSTRUCTED IN 2 LAYERS, USING MIN. OF 3% BY WT. OF EMUL. ASPH.
FILL OVER EXISTING PAVEMENT USED TO INCREASE HEIGHT OF CROWN; SHALLOW FILLS MADE OF ASPH. CONCRETE COMPOSED OF CRUSHED ROCK MIXED WITH 6% TO 7.25% BY WT. OF EMUL. ASPH; DEEP FILLS MADE OF EMUL. ASPH. STABILIZED QUARRY RUN ROCK, USING MIN. OF 3% BY WT. OF EMUL. ASPH.

COST OF RUNWAY SURFACE

BASE AND SUB-BASE $ PER SQ. YD, EXCLUSIVE OF GRADING, DRAINAGE, ENGINEERING, ETC.

DRAWN BY	CHECKED BY	APPROVED
		(TITLE) L. T. McAfee UTILITIES ENGINEER

Fig. 19.—San Francisco Airport, San Francisco, Calif.



GENERAL NOTES

AIRPORT IS LOCATED 7 MILES SOUTHEAST FROM BUSINESS CENTER OF SIOUX CITY

4" CONNECTED SUBGRADE, PI of 15 having 10% to 13% clay - 40% to 60% silt - 30% to 50% sand and 20" to 40" per 5" bearing value.
4" STABILIZED BASE, PI of not more than 35 having 20% large gravel - 20% fine gravel - 40% to concrete sand - 5% river sand - 15% to 5% natural soil. Base to be mixed, and rolled with a sheeps foot roller.
PRIMER ON BASE, ⅓ gal MC #1 if necessary.
1½" ASPHALT CONCRETE SURFACING, Composed of gravel, concrete sand, river sand, yellow clay and 6% M.C. #2

COST OF RUNWAY SURFACE

WORK NOT YET DONE. WPA COST UNKNOWN
BASE AND SUB-BASE $ PER SQ. YD, EXCLUSIVE OF GRADING, DRAINAGE, ENGINEERING, ETC.

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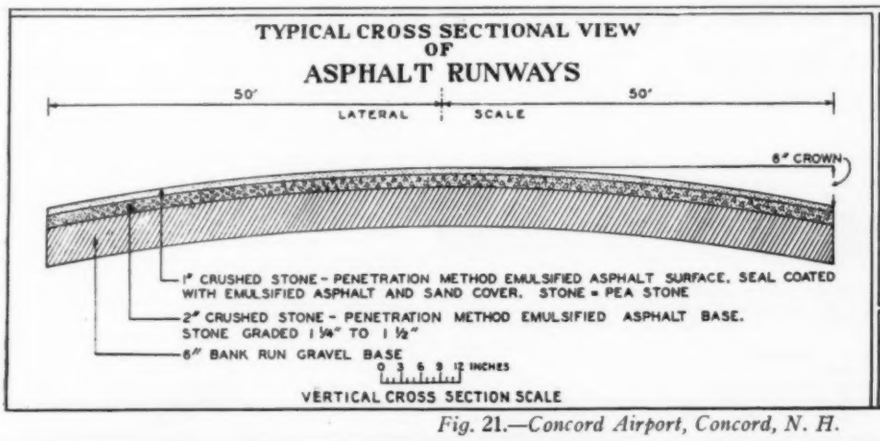
		(TITLE) CITY ENGINEER

Fig. 20.—Sioux City Airport, Sioux City, Iowa.



GENERAL NOTES

AIRPORT IS LOCATED 1.5 MILES EAST FROM BUSINESS CENTER OF CONCORD, N.H.

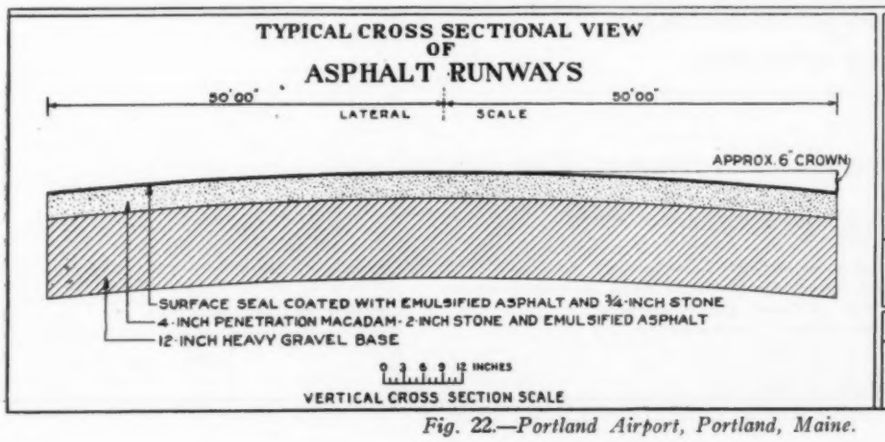
NATURAL BASE - COURSE SAND.
6" GRAVEL BASE - BANK RUN GRAVEL LAID IN 2" LAYERS, EACH LAYER WET AND ROLLED WITH TEN TON ROLLER.
2" CRUSHED STONE EMULSIFIED ASPHALT BASE - ASPHALT APPLIED PENETRATION METHOD, 1 GAL. PER SQ. YD. ROLLED, BEFORE & AFTER ASPHALT APPLIED, WITH FIVE TON ROLLER.
1" PEA STONE EMULSIFIED ASPHALT SURFACE - ASPHALT APPLIED PENETRATION METHOD, 1 ¼ GAL. PER SQ. YD. SAND COVER. ROLLED, BEFORE & AFTER ASPHALT APPLIED, WITH FIVE TON ROLLER.

COST OF RUNWAY SURFACE

BASE AND SUB-BASE $0.75 PER SQ. YD, EXCLUSIVE OF GRADING, DRAINAGE, ENGINEERING, ETC.

DRAWN BY	CHECKED BY	APPROVED
G.A.F.	E.E.B.	(TITLE) CITY ENGINEER

Fig. 21.—Concord Airport, Concord, N. H.



GENERAL NOTES

AIRPORT IS LOCATED 3.6 MILES WEST FROM BUSINESS CENTER OF PORTLAND

EXISTING SOIL EXCAVATED AND GRADED AND A ONE FOOT DEPTH OF HEAVY GRAVEL PLACED AND ROLLED. FINISHED SURFACE COMPOSED OF 4-INCH CRUSHED STONE PLACED AND ROLLED AND PENETRATED WITH EMULSIFIED ASPHALT FOLLOWED BY A SEAL COAT OF EMULSIFIED ASPHALT COVERED WITH ¾-INCH STONE AND ROLLED.

COST OF RUNWAY SURFACE

BASE AND SUB-BASE $ PER SQ. YD, EXCLUSIVE OF GRADING, DRAINAGE, ENGINEERING, ETC.

DRAWN BY	CHECKED BY	APPROVED
F.M.C.	R.E.M.	(TITLE) COMMISSIONER OF PUBLIC WORKS

Fig. 22.—Portland Airport, Portland, Maine.

AIRPORT RUNWAY CROSS-SECTIONS

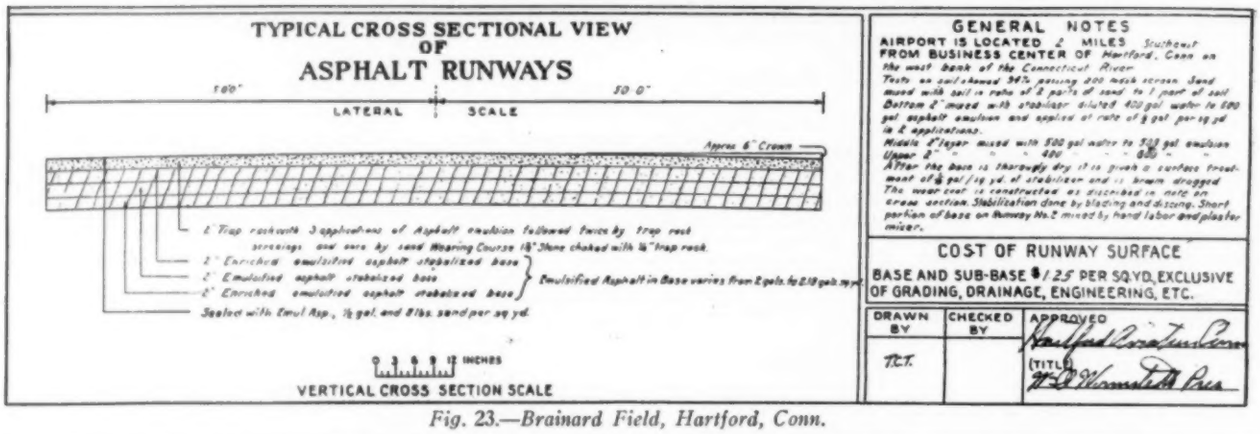


Fig. 23.—Brainard Field, Hartford, Conn.

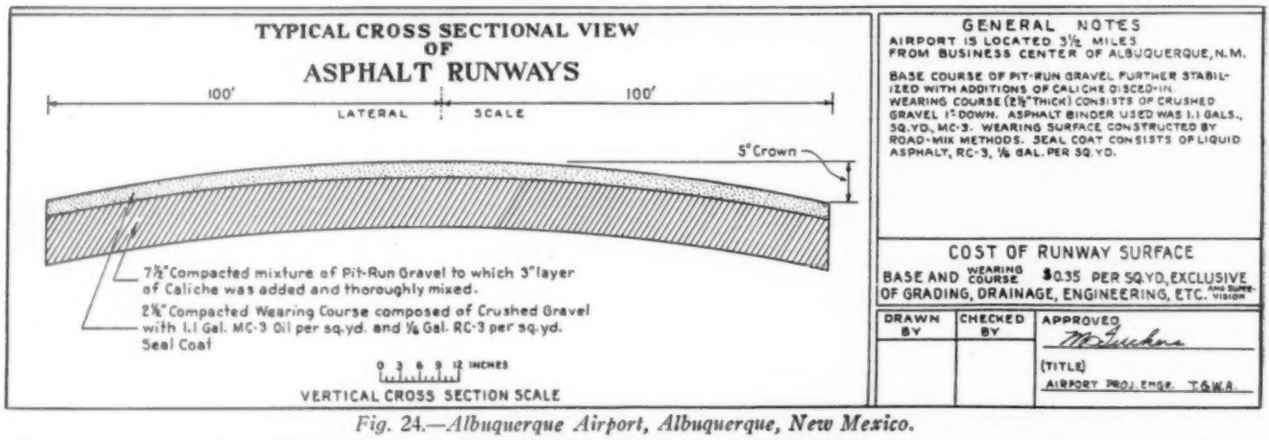


Fig. 24.—Albuquerque Airport, Albuquerque, New Mexico.

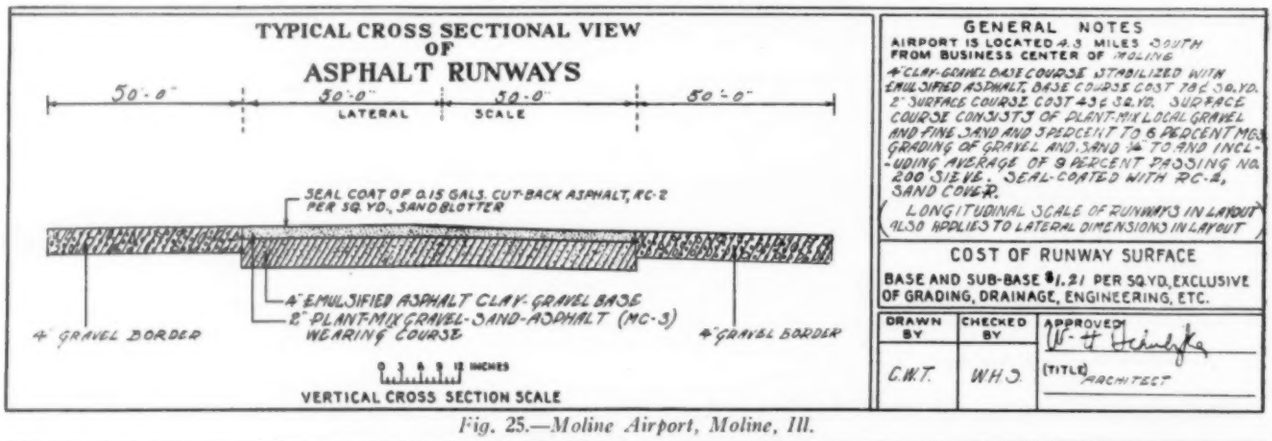


Fig. 25.—Moline Airport, Moline, Ill.

Fig. 26.—Municipal Airport, Iowa City, Iowa.

AIRPORT RUNWAY CROSS-SECTIONS

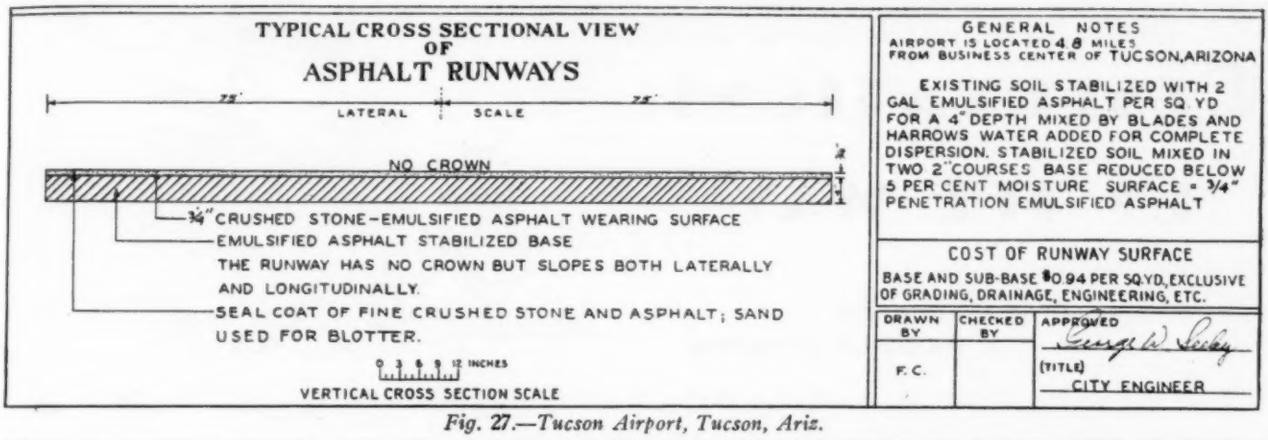


Fig. 27.—Tucson Airport, Tucson, Ariz.

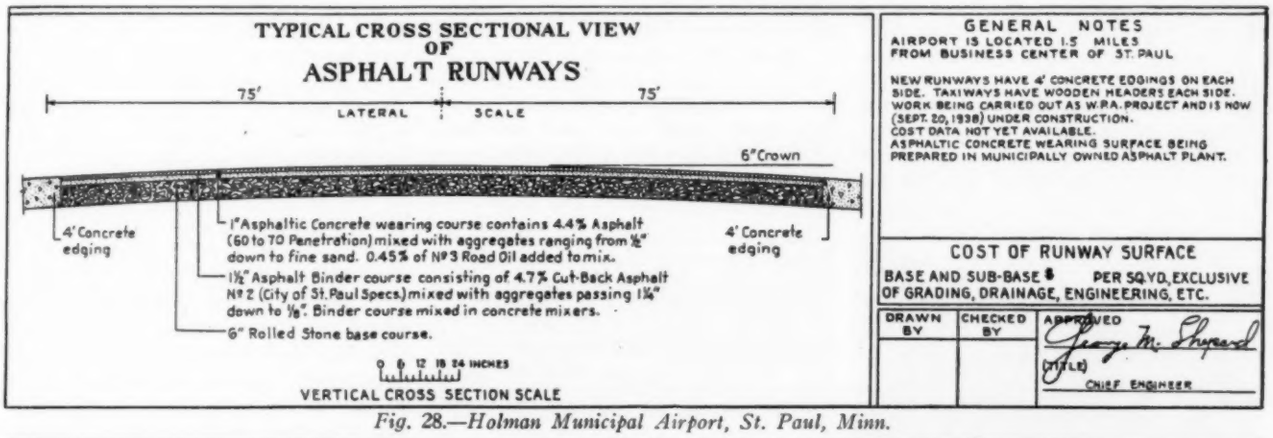


Fig. 28.—Holman Municipal Airport, St. Paul, Minn.

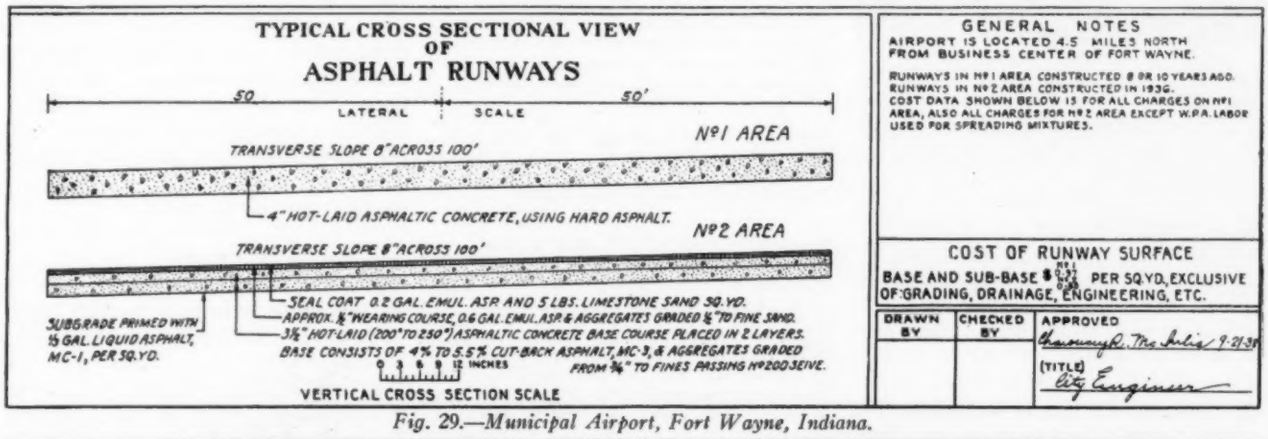


Fig. 29.—Municipal Airport, Fort Wayne, Indiana.

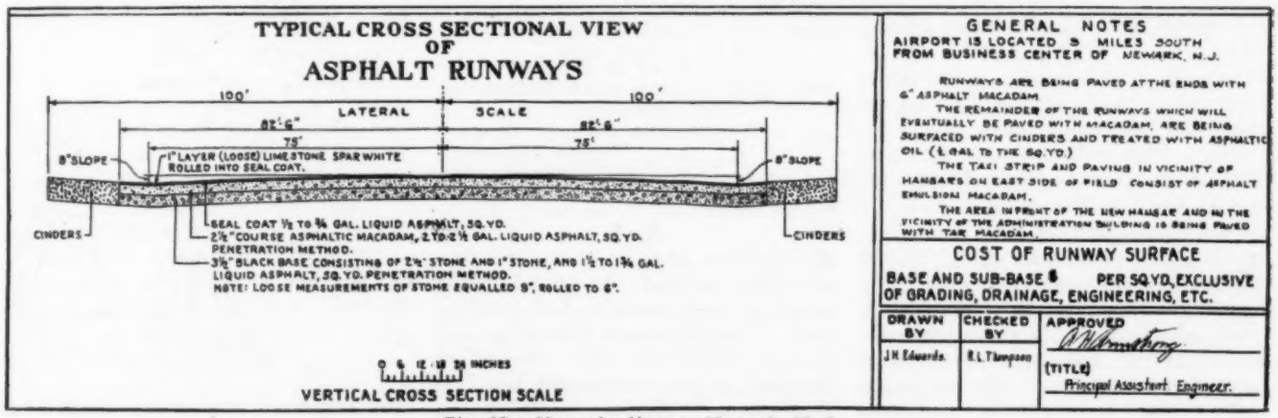


Fig. 30.—Newark Airport, Newark, N. J.

OBSERVATIONS BY THE WAY

By
A. PUDDLE JUMPER

¶ See the officer sitting in the car? He has a stop watch in his hand. How do I know? He stopped me in Victor, Iowa, because I exceeded the village's 25 mi. per hr. speed law. Down the road within his sight he has a mark. 330 ft. further he has another. By clocking a car he checks the speed. He made me go out of town and come back again within the proper speed. I wasn't the only one, either.

• •

¶ Take it for what it's worth: "Goodby, God, we're going to Arkansas," or "Good, by God, we're going to Arkansas." Commas or voice, inflection can be important. But why pick out Arkansas?

• •

¶ Powers of Arizona was telling me about a method of resurfacing rigid pavements, that I never heard before. He says they place a cushion course of stabilized soil which, at the minimum point is 1½ in. thick, on top of the rigid pavement before they resurface with a bituminous mixture. He says it prevents cracks from coming through to the surface.

• •

¶ I saw a novel idea on U. S. 80 in Texas on the concrete bridges. The state had cantilevered walkways on both sides, outside of the heavy concrete handrail, and made them of steel plate for the floor and pipe for handrails. They were painted aluminum and looked very good.

¶ From the Montana "Center Line," we glean the following:

THE ENGINEER
(Author Unknown)

Who comes with pencil sharpened keen,
With profile long and sober mien,
With transit, level, book and tape,
And glittering axe to swat the stake?

Who sets his level, bends his spine,
Squints thru the glass along the line,
Then waves both arms at a rapid rate,
Yells, "Hold that . . . rod up straight"?

Who turns with haste the figured page,
And tears his hair with maddened rage,
And then with patience out of joint,
Ties in another reference point?

Who rises and snorts like one insane,
Jumps in the air and claws his mane,
Whene'er he sees a fresno take
A whack at his most cherished stake?

Who swears he'll charge "an even ten"
For stakes destroyed by mules or men,
While on all fours he tries in vain,
To find the vanished stake again

Who deals with figures quite profuse,
And tells you solid rock is loose,
That hard pan's nothing more than loam,
And gumbo's lighter than sea foam?

Who calls it your "unrivalled gall"
Whene'er you kick for overhaul,
And gives your spine the frigid chill,
Whene'er you spring an "extra" bill?

Who, after all, commands our praise,
In spite of his peculiar ways,
While others harvest all the gains,
That spring from his prolific brains?
THE ENGINEER.

Submitted by Fred M. Brown,
Division Engineer.

Can anybody tell us who was the author of this poem?

• •

¶ Favorite pastime at conventions: Standing around the hotel lobby, smoking, and trying to feel comfortable. Chief Engineer Purcell of California expressed his discomfort. Dressed in his "soup and fish," he kept saying to his partner, "Come on, let's get out of here."

¶ OH, MAMMA!—One of the current popular songs recites the thrills of a demure girl when she receives the glances of the butcher boy, the baker boy, etc. Each time she exclaims, "Oh, Mamma!"

That there is sound business in that "Oh, Mamma" psychology is demonstrated by a firm retailing gasoline in Milwaukee, Wis. Several attractive girls were hired as hostesses. They wiped off the windshields with such pleasing smiles that the male attendants received scant attention. Complaints were made by the men, who asserted that the girls were causing too many "Oh, Mamma" exclamations from male customers, thereby disrupting orderly course of the business. But the management pointed out since the girls had "manned" the station, business had increased to such an extent that an additional male attendant had to be hired.

• •

¶ Herewith a couple of state highway engineers welcoming me to their states.

¶ Pennsylvania state highway department maintenance men cleaning mud off the highway in the interest of greater safety. With prospects of a freeze they decided that if the mud

froze, motorists would encounter skidding conditions. The picture was taken at the intersection of U. S. 6N and Pa. 18, where the latter goes north to Erie.

• •

¶ Incidentally, having a meeting of the A. A. S. H. O. in your state is a good idea. It causes all engineers to spruce up their roads. The route of the Texas Caravan after the A. A. S. H. O. meeting showed all the earmarks of action similar to that kind of preparation a military outfit experiences in getting ready for an "inspection." Even the metal protection plates on the piles of the ferry slip near Galveston were freshly painted. The Galveston ferry boat was slicked up like a brand new band box.

• •

¶ Speaking of ferry boats reminds me of the story about the gigolo who asked a longshoreman one day whch way it was to the ferry boat. Gruffly the longshoreman replied, "Well, I'll be d—d, I knew there were a lot of you guys in New York, but I never knew you had a boat."

• •

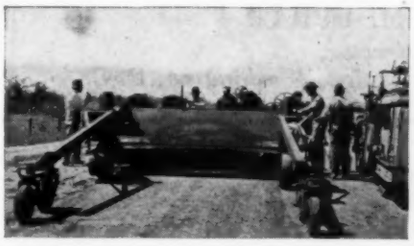
¶ George Martin, Consulting Engineer, Barrett Company, told me off pretty smoothly in Washington during the Highway Research Board meeting. Last fall I wondered (in print) if the black-top road surface being placed on a wet concrete slab surface just west of Baldwin, N. Y., would stick. George wrote me about a recent inspection he had made and, by letter, assured me that the job was fine. I failed to acknowledge this letter, expecting to print a portion of it, when I needed material. Smoothly, friend Martin reminded me I failed to acknowledge his letter. He knew that I think the failure to acknowledge correspondence is an unpardonable sin. I probably would have blushed, were it not for the fact that my skin is thick, tough, and tan.

• •

¶ Congressman Wilbur Cartwright of Oklahoma (apparently both sides of the Red River claim him) was talking about his friend, the next speaker, Senator Connally of Texas. He told this story about the time that Connally was ill and had called a physician to diagnose his ailment. The absent minded doctor reached into his black bag, pulled out an instrument and inserted the instrument in Connally's mouth. Then he took his wrist to count the pulse. The instrument was a barometer instead of a thermometer. Absent-mindedly, still, he read it and said, "You're dry and windy."

• •

¶ This man Jagoe, president of Public Construction Company, Denton, Texas, is a highway contractor with a flare for invention and a desire to attain construction perfection. I have already shown pictures of road machinery which he has developed. Herewith is a picture of an attachment for an Adnun black top paver that he has developed with the



idea of attaining smoother surfaces. It is a knee-action, hydraulically actuated pair of extended arms that operate on a principle similar to knee-action in motor vehicles. Roughness coefficient of surface was reduced from 140 per mi. at 60 mph to 20 or 25 per mi. at 60 mph with the same automobile.

• •

¶ I have always contended it can't happen to me—but just out of San Antonio, Texas, on that undivided portion of the 4-lane road to Austin, it nearly did. All I can recall of that uncontrolled, meteoric automobile speeding at me not 2 car lengths away is the shape of the front tire and the screech of rubber. To avoid striking me as I moved along in my own outside lane, the driver of the careening meteor cut his wheels back toward his own side of the road. The tire was bulged completely under the car which gave the wheel the appearance of riding on the rim. I should have stopped and punched the d— fool driver smack on the nose. He had enough trouble, though, when he finally ended up through the fence over in the field on the right.

• •

¶ At a highway engineers' banquet, somewhere—Lansing, Michigan, as I recall—we got to talking about high-priced words. Harvey Whipple, Secretary of the American Concrete Institute, I believe it was, who said one word that cost him $17.00 was "ageratum." I've heard of high-priced words like "intertransubstantiationist" and "phenoltetrachlorophthalein," but they never cost any $17.00.

• •

¶ On the A. A. S. H. O. Texas Caravan trip A. P. J. was really jumping puddles. Along one road on the way to Corpus Christie from the north I passed a puddle about 50 ft. in diameter with a dike all around it. Waves of water were shooting high into the air. The Texans tell me it is an uncontrolled gas well that has been going wild for two years.

And then, it's quite a puddle over which Rear Admiral Van Lundin's navy operates.

• •

¶ Under construction on U. S. 522 near Hancock, Maryland, is a long bridge. It is known to Marylanders as Tabler's Folly but it certainly was a bargain for West Virginia. Politics does funny things.

• •

¶ Experimental crash bumper installed at street car loading platform in Middletown, Ohio. The smooth metal cylinders, which have open ends, are so designed that if struck

head on by an automobile will collapse successively and bring the vehicle to a stop without serious damage to the car or driver.

• •

¶ Some highway highlights of 1938: Commendable reduction in traffic toll; changes in at least 10 states of highway directors or chief engineers due to political changes; flood of super highway bills introduced in Congress; both the amount of work done per mile of improvement, and the total mileage improved considerably exceeded the average rates over the past 10 years; surface smoothness of Ohio's highways greatly improved; three states, California, Michigan and New Hampshire, adopted constitutional amendments against diversion, thus joining the ranks of Colorado, Kansas, Maine, Minnesota and Missouri.

American Road

WASHINGTON, D. C.

COMMITTEE ON DIVERSION REPORT

Down the Road

By CHARLES M. UPHAM
Engineer-Director,
American Road Builders' Association, Washington, D. C.

GOOD ROADS PROVIDE DENTAL CARE

A trip to the dentist holds no terrors for many rural residents of Louisiana today—not because more powerful anesthetics have been discovered to alleviate the pain of dental drilling, but because rural Louisianians no longer have to dread going to the dentist. The dentist comes to them on the wheels of a streamlined trailer over an improved secondary road.

A unique system of providing dental care for the poor by means of mobile dental units which travel through remote rural sections of the state was established in December, 1937. Inauguration of this "dentistry on wheels" was based on the realization that poverty is very often due to poor health, and poor health may, in many cases, be blamed on bad teeth. The Louisiana Hospital Board, therefore, began operation of twelve dental trailers, each containing a fully equipped dentist's office on wheels towed by an automobile, to provide the needy with dental treatment they could not otherwise receive. Many farmers and their families have received their first dental treatment in one of these trailers. An average day sees the treatment of fifteen persons in each of these units.

Since establishment of this service, the trailer dentists have made it possible for nearly 40,000 persons to have their teeth cleaned, treated, filled or extracted. It is expected that, as a result of the system which has now passed the experimental stage, the general health of the rural citizens will be greatly improved and many citizens now incapacitated because of ill health will be made self-supporting. Particular benefit should be reflected in the children and younger people who are now able to receive expert dental care during the first stage of tooth defect. The state itself will benefit from the decrease of people on the relief rolls and the increase of strong, healthy citizens. While the action of the hospital board in establishing this service a year ago is directly responsible for these advantages, much credit must also go to the state highway department. If improved highways had not made it possible for these trailers to travel into rural areas, thousands of farm families would still be deprived of dental aid. Bad roads would slow down the units, drastically reduce the number of calls that could be made in one day and, in many cases, completely prevent the traveling dentist from reaching many sections of the state.

While trailer-dentistry is something new under the sun, traveling nurses have been bringing medical aid to farm homes for more than 25 years. A survey made in 1937 shows 5,140 nurses of the United States Public Health Service engaged in rural health activity. These nurses care for the sick and teach the farm families to care for themselves. Courses in first aid and hygiene are on the program of many rural communities. Rural interest has been awakened in improvements for sanitary facilities, water supplies and the eradication of disease-encouraging conditions around homes and farms. The rural nurse, with her black bag of modern medicine and her late model automobile, is producing very tangible results. The constant improvement of the state highway system will make it possible for her to increase the scope of her activities, to widen the area of her visits and to make medical assistance and nursing care for the rural family an always-available aid, rather than an infrequent luxury.

COMMITTEE ON DIVERSION REPORT TO HIGHLIGHT ARBA CONVENTION

The report of the ARBA Committee on Diversion, which will be presented at the 1939 Convention and Highway Exhibit of the American Road Builders' Association in San Francisco's Civic Auditorium, March 7-10, will serve as a guidebook for anti-diversion campaigns throughout the country. At a committee meeting in Lansing, Mich., on January 4, it was decided to publish this report in a 50-page "bible" to help good roads advocates in their efforts to secure passage of anti-diversion amendments to the constitutions of states that still practice the misappropriation of highway money to non-highway projects. This anti-diversion "bible" will contain a complete case history of the methods and procedures used by the seven states that have already been successful in obtaining amendments. It will also include a complete statistical summary of all highway funds diverted in the various states to date and the amount of good and safe roads that could have been built with this money. A survey issued by the ARBA committee shows that campaigns for anti-diversion amendments are now under way in ten states. Most of the state legislatures will meet this year and a plan of action was outlined at the Lansing meet to prevent groups within these legislatures from cutting further inroads in the highway funds. Diversion will be only one of the timely and important highway subjects considered at the 1939 ARBA Conclave. Delegates from the forty-eight states and twenty-five foreign countries will learn about the modern methods and see the modern machines and materials that they will use to build the "Highways of Tomorrow." Word has gone out that the 36th annual Convention and Highway Exhibit of the American Road Builders' Association will be the starting gun for tomorrow's increased highway construction.

Builders' Review

FEBRUARY, 1939

TO HIGHLIGHT A. R. B. A. CONVENTION

With Our State Groups

ALABAMA

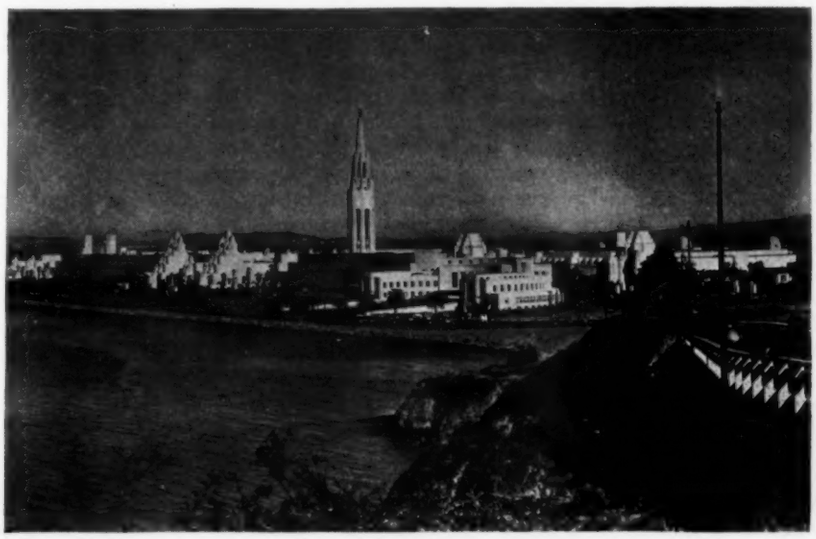
The seventh annual meeting of the Alabama Road Builders' Association was held in the Whitley hotel at Montgomery on February 1. Officers for 1939 were elected and William C. Slee, assistant engineer-director of the ARBA, addressed the convention on "The Trend of National Highway Legislation." Frank M. Dixon, new governor of Alabama, outlined his road program for the next four years at the banquet in the evening. Congressmen Frank Boykin, Luther Patrick and John J. Sparkman and Senator Lister Hill were honored guests. Alex Hancock, who has been president of the association for the past seven years, presided.

MICHIGAN

The Michigan Good Roads Association staged its second annual statewide banquet on February 3. Composed of all Michigan associations concerned with good roads, including the Michigan Road Builders' Association, ARBA affiliate, the federation was host to approximately 2,000 guests. Governor Frank D. Fitzgerald of Michigan, ARBA Engineer-Director Charles M. Upham and ARBA President and Michigan State Highway Commissioner Murray D. Van Wagoner were banquet speakers. Carl Bowen of the Ottawa County Road Commission is president of the federation and Otto Hess of the Kent County Road Commission served as general chairman of the banquet. Floyd E. Koontz, secretary of the MRBA, assisted him.

OHIO

The convention meeting of the Ohio Division, ARBA, will be held at the Neil House in Columbus on February 23. Speakers at the afternoon session will show the importance of the state's road-building industry to contractors, machinery manufacturers, supply dealers, professional engineers and labor. The 1939 anti-diversion program will be stressed at the evening banquet. The president, secretary and treasurer will report at the morning business sessions. Officers will be elected at a dinner-meeting of the board of directors on February 22.



WESTWARD HO!

ROAD BUILDERS who plan battles against the diversion of highway money at convention sessions of the ARBA Pacific Coast conclave will find a much pleasanter form of diversion awaiting them in their leisure hours. "Time out" for delegates to the 1939 Convention and Highway Exhibit will undoubtedly mean a trip across the Bay to Treasure Island. Pictured above are some of the palaces and towers constructed for the Golden Gate Exposition, which will be in full swing during the ARBA meet. Road builders can profitably and enjoyably divide their time between the "Highways of Tomorrow" in San Francisco's Civic Auditorium and the kaleidoscopic picture of America yesterday and today on Treasure Island. Also shown above is part of the six-lane causeway leading from the San Francisco-Oakland Bay Bridge, another main attraction for members of the highway industry and profession.

Value of MODERN TOPOGRAPHIC MAPPING for Highway Surveying

By J. C. CARPENTER

Senior Highway Engineer, District No. 6, U. S. Bureau of Public Roads

TOPOGRAPHIC mapping of land areas may be classified, historically, in two periods, ancient and modern. The periods are clearly separated on the date of December 17, 1903, when the Wright Brothers with their 12 hp. motor flew for 12 seconds and on a fourth attempt soared 852 feet in 59 seconds. This was the birthday of aviation and also of modern mapping, for now airplanes with dependable engines, ample weight carrying capacity, increased cruising radius and performance at high altitudes, have made aerial photographs practicable anywhere. With modern cameras we obtain, in a few hours, an extraordinarily detailed, accurate, permanent survey record that by ancient methods would require years of work and when completed would not even approach the perfection of detail of modern maps.

History of Mapping.—Our first authentic knowledge of the use of maps dates back to 3800 B. C. when the Babylonians are reported to have made a cadastral survey of their entire kingdom and left a few clay tablets containing what must have been an outline of their domains. The earliest record of an interest in map-making is contained in Strabo's statement that the Greeks "honored Anaxamander (6th Century B. C.) not only as the first man who tried to fix the bounds of the earth, but as the inventor of cartography." ("Old Maps and Their Makers." Louis A. Holman.)

The first known reference to the properties of the magnetic needle is found in 1187, and the earliest mention of its variation was on Columbus' first voyage in 1492. During the 15th Century, several important developments promoted the increase in knowledge of the world, the most important being the invention of printing, the voyages of Marco Polo, Columbus, Magellan, and others, and the correction of the prevailing system of astronomy by Copernicus. In the 16th Century, Gerhard Kramer, known to fame as Mercator, and his friendly rival, Abraham Ortelius, set the stage for making of maps of the world as we know them today. From that date to the present moment adventurers, explorers, navigators, and scientists have woven a network of crossed paths on the face of the earth and with compass, sextant, theodolite and log have mapped our globe.

Definite progress in photography was made through the use of the camera by scouting planes in the World War to bring back a record of enemy positions. The stereoscopic process of development of contours from aerial photographs has been perfected since the war.

Thus, it is seen that our modern maps are distinctly different from those prepared before we could rise above the land, make a faithful record of our observations on a sensitized plate or film, return to earth and, utilizing geodetically determined horizontal and vertical coordinates and the stereoscopic principle, transfer this record to a reliably accurate map showing a wealth of detail never before possible.

In this modern mapping there are two distinct essentials: Accurate and comprehensive control and reliably correct development of topography. The first requirement is met by geodetic control, and the second by the use of precise cameras, accurate flying and delineation of the contour lines by skillful operation of modern machines built to operate on the stereoscopic principle.

Geodetic Control.—The foundation for complete geodetic control for the country has been laid, carefully checked and adjusted and is now ready for the erection of the framework that will be necessary for a complete mapping program. Present-day mapping, if executed without geodetic control, will be as unsatisfactory as the skyscraper without steel framework.

Horizontal Control.—The first triangulation station was established by Ferdinand R. Hassler on July 16, 1817, in Passaic County, New Jersey, about 15 miles northwest of the center of Manhattan, New York City, and from this beginning the horizontal network has been projected over the entire country. The first extensive adjustment to obtain reliable latitudes and longitudes for the stations along its length, was made on the transcontinental arc extending from Cape May, New Jersey, to Point Arena, California, a distance of 2,750 miles. The field work was accomplished from 1871 to 1897. By 1926 the net had been extended sufficiently to allow a final adjustment of the entire system to serve as a national basic datum for all time. Dr. William Bowie, then Chief of the Division of Geodesy, suggested a method of adjustment which is very rigid, gives full weight to all observations including base measurements and Laplace azimuths, and has met every practical requirement. This method was developed by Dr. O. S. Adams and used in the adjustment of both the western and eastern parts of the country. In this adjustment the position of the station at Meade's Ranch in Kansas was held fixed and all other positions were checked and new geographic coordinates computed. Thus, the adoption of the North American 1927 datum was accomplished and positions on this datum will be continued in use without change, indefinitely, except where actual earth movements are known to take place. In the United States alone this datum includes about 69,000 miles of triangulation, 55,000 first and second order triangulation stations, 210 first-order and 54 second-order bases, 840 latitude stations, 691 longitude stations

and 1,152 azimuth stations. This datum has been extended through British Columbia to Alaska and into Mexico.

There are many great advantages to be obtained from a strong rigid national standard horizontal control datum. In mapping, such a control is absolutely essential to avoid disastrous confusion, and to prevent gaps and overlaps when detached surveys are later joined together. It is essential in settling boundary disputes, for reclamation and flood control, and in fact for every activity dealing with ownership and use of lands.

Vertical Control.—Precise or first-order leveling was initiated by the U. S. Coast and Geodetic Survey in 1878 and followed the transcontinental arc of triangulation along the 39th parallel. The national net now comprises more than 263,000 miles including 150,000 beach marks. The last general adjustment of this net was made in 1929 and includes all the leveling in this country as well as some in Canada and also 26 tide stations on the Atlantic, Gulf and Pacific coasts. The value of a single leveling datum for universal use cannot be over-emphasized. Without such a common datum, confusion and chaos are bound to result. In New York City there were at one time eight independent datums used by as many organizations.

It is important and essential that geodetic horizontal and vertical control be extended as rapidly as possible. The maximum immediate benefit from this control will accrue to the public if these extensions are carried along the important highways of the country. The densest population and highest land values are found along these highways. The skeleton network has been established and adjusted, and we are now ready to bring it down to earth. The best way to do just this is to project the triangulation along the highways. The establishment of points at readily accessible locations along the main highways at such frequent intervals that they are intervisible, the computation of their latitude and longitude and conversion to plane coordinates will allow the use of this universal datum, not only for all highway surveys, but for all other types of surveys, including all of the very important land boundary surveys. Highway engineers can bring about this most logical development by familiarizing themselves with the procedure to be followed in using this control and applying it to all their locations where the present network is available. For surveys near the existing arcs there will be very little additional cost of these ties, and as the procedure becomes routine it is entirely probable that the final cost of surveys will be materially reduced due to the accurate location of the numerous points. Certainly the value resulting from having all points located definitely and coordinated on one world-wide datum will be worth any small additional cost involved. After highway engineers realize the value of this procedure, it seems logical to presume that there will be an insistent demand for the extension of the control along the major highways where it can be used as a rigid base for all surveys and mapping. The Coast and Geodetic Survey has evolved a method of conversion of geographic coordinates to x and y plane coordinates which is so simple to apply that any surveyor or engineer can use it. It is as simple as the use of geodetic bench marks in leveling with the wye level, and certainly no engineer will use an assumed datum for his levels when he can start from a bench mark whose elevation above sea level has been established and adjusted.

Development of Topography.—Mapping with aerial photography involves three steps: (1) The photography, (2) the extension of control to each picture area, (3) the office procedure of converting the information on the prints to usable contour maps.

Photography.—On April 1, 1938, 1,505,100 square miles of the continental United States had been photographed. Six million dollars have been spent by the Department of Agriculture since 1926 and 65 per cent of the area was photographed for the Agricultural Adjustment Administration for determination of crop areas and not for mapping.

A large part of the air photography in the United States has been done using conventional commercial and military aircraft. The Fairchild Corporation has two planes equipped especially for air photography and the Abrams Aircraft Corporation has recently completed a plane especially designed for air photography which differs radically from conventional types. It has the following special features: forward and downward visibility, rapid climbing ability, high cruising speed, stability, long cruising radius, supercharged motor and oxygen supply for the crew when working at high altitudes.

The greater part of the photography in the United States has been done with five-lens, tandem-five-lens, and single-lens cameras. Great advances have been made in the development of precision cameras. The most recent of these is the nine-lens camera developed by the U. S. Coast and Geodetic Survey. This machine can photograph in one exposure, at an elevation of 21,780 feet, 313 square miles. This means that a strip 18 miles wide can be covered and the scale will be one half mile to the inch on the original film. Lieut. Reading says of this camera, "Last summer I sat operating the nine-lens camera of the Coast and Geodetic Survey as we flew along at 160 miles per hour in an Army Air Corps bomber three miles above the earth's surface. All I had to do was watch the sights and levels while about every minute and forty seconds the shutters clicked and a fresh bit of film was automatically wound up. In an eighteenth of a second the light reflected from the earth below had recorded on that film every meander of coast and stream, every road, every building, every field and detail of importance in more than 120 square miles of terrain. We finished photographing the 1400 square miles in which we were interested with every detail photographed on 1:20,000 scale, with plenty of overlap, in an hour and flew back to Washington." A normal single lens camera will cover about 1/20 the area included in a single exposure of the nine-lens camera, a wide angle single lens 1/9 the area, and a tandem five-lens about 83%. With the larger area covered proportionately less ground control is required.

Field Work on Ground Control.—After the photographs have been taken the ground horizontal and vertical control must be projected on the photographs. The prints are examined and prominent points selected to be tied in to the horizontal and vertical control. The stereoscopic plotting machine is capable of bridging fairly wide gaps in horizontal control, but obviously the larger the area covered by each exposure the wider the control lines may be spaced. With the more modern precise cameras, the vertical control can be spaced along the horizontal control, but with the older equipment a line of levels must be run along the lateral margins of each flight of pictures. The field parties carry the contact prints with them and select "picture points" such as road intersections, fence corners, building corners, lone trees or shrubs, oil derricks, and bridge abutments.

Stereoscopic Plotting.—Since 1920, numerous machines have been perfected for the development of contour maps from aerial photographs. The multiplex

aeroprojector is one of the successful machines of this character and two of them are now in use at Temple, Texas, on the mapping of the Brazos River Valley by the Brazos River Conservation and Reclamation District. This machine is operated on the stereoscopic principle and has been found to produce excellent maps at a very reasonable cost. Major Haquinius gives the cost of mapping by this method as about $44 per square mile for maps on a scale of 1:12,000 (1″ = 1000′) and a contour interval of 10 feet. This cost includes aerial photos, horizontal and vertical control, stereoscopic plotting, drafting, editing, and technical overhead. Costs of mapping on this scale by ancient methods would have been from three to five times as great and results not nearly as satisfactory for the wealth of detail and accuracy obtainable from aerial photographs cannot be duplicated by plane-table methods. The photographic method has an additional distinct advantage in that any question in reference to the detail shown on the finished map may be settled by inspection of the photograph while a question on a plane-table map requires the reoccupation of all the survey points in the field.

The uses for accurate, complete maps on suitably large scales are legion. Hundreds of different special purpose maps can be compiled from them, special studies can be made that were never thought of, entirely unpredictable at the time of survey. Hence, in mapping it is well to have a reasonable factor of safety to insure that the maps when put to the test, will satisfactorily serve every purpose that can reasonably be expected. Accuracy beyond immediate needs can be obtained without additional cost and it is well worth striving for.

Engineers, with a very few exceptions, are indifferent to the value of modern maps. There are very few projects started where adequate modern maps are available. Special surveys must be made for each case and when the work is completed, the surveys have little or no value for any future work. No doubt the cost of adequate complete maps could have been saved many times over, and better planned construction resulted if we had had these maps for all construction work performed in this country. Highway engineers can materially aid in the development of better surveying and mapping, by utilizing geodetic control for their surveys and joining in the effort that is now being made to extend the topographic mapping of the country.

There is need for a revamping of the standards now in vogue for map scales. The majority of the topographic maps of the country have been made on a scale of 1:62,500 and 1:125,000 corresponding to scales of approximately 1″ = 1 mile and 1″ = 2 miles, respectively. These scales have come down from a division started on the 1:1,000,000 scale. There is no reason for continuing to map on this scale, and there should be a definite conclusion as to the best scales to be used for future work. At this time it seems logical to advocate scales starting from the other end of the mapping procedure. Highway maps are drawn on a scale of 1″ = 100′ and engineers' scales are divided into 12 inches and tenths of inches or multiples thereof. It is therefore suggested that we recommend scales of 1:1,200; 1:2,400; 1:6,000; 1:12,000; 1:24,000, and 1:48,000. For contour intervals, use 1′, 2′, 5′, 10′ 20′ and 40′. Such scales will allow the universal use of the engineers' scale and will provide a direct relation between the contour elevation and the horizontal scale to the per cent of grade.

$10,000,000 APPORTIONED FOR THE NATIONAL FOREST HIGHWAYS AND TRAILS

The Secretary of Agriculture has apportioned by states—for the fiscal year beginning July 1—the sum of $10,000,000 for National Forest highways, truck trails, and trails.

The sum of $6,666,667 represents the forest highway fund, by law expended upon those main forest roads within National Forests which serve the needs of public travel. Forest highways are generally part of the State highway systems. Projects are selected cooperatively, with the Forest Service, Bureau of Public Roads and State Highway Commissions participating, and construction work usually is by Public Roads. The forest highway apportionment is based 50 per cent on the net area of National Forest land within each participating State and 50 per cent on the value of these Government lands. It is not required that these funds be matched by the States.

The sum of $3,333,333, the forest road development fund, is for the construction and maintenance of truck rails and horse and foot trails by the Forest Service within and adjacent to the National Forests.

The apportionments of the forest highway and forest road development funds are as follows:

FOREST HIGHWAY FUND

State	Sum Apportioned	State	Sum Apportioned
Alabama	$ 92,020	Nevada	$121,561
Alaska	400,000	New Mexico	273,502
Arizona	388,946	North Carolina	35,332
Arkansas	81,752	North Dakota	24
California	952,825	Ohio	1,353
Colorado	489,680	Oklahoma	53,967
Florida	42,695	Oregon	898,443
Georgia	23,015	Pennsylvania	17,040
Idaho	687,173	Puerto Rico	1,427
Illinois	6,559	South Carolina	20,091
Indiana	1,514	South Dakota	52,691
Iowa	31	Tennessee	20,820
Kentucky	12,099	Texas	21,057
Louisiana	13,573	Utah	224,463
Maine	2,549	Vermont	8,824
Michigan	53,978	Virginia	40,129
Minnesota	84,789	Washington	459,350
Mississippi	28,052	West Virginia	76,658
Missouri	28,035	Wisconsin	34,632
Montana	535,677	Wyoming	295,816
Nebraska	17,409		
New Hampshire	67,116	Total	$6,666,667

FOREST ROAD DEVELOPMENT FUND

State	Sum Apportioned	State	Sum Apportioned
Alabama	$ 27,943	New Mexico	$109,847
Alaska	21,614	North Carolina	40,479
Arizona	128,614	North Dakota	80
Arkansas	40,450	Ohio	2,576
California	534,557	Oklahoma	4,706
Colorado	137,680	Oregon	376,144
Florida	18,698	Pennsylvania	18,202
Georgia	19,361	Puerto Rico	4,340
Idaho	492,664	South Carolina	31,500
Illinois	23,970	South Dakota	14,818
Indiana	7,711	Tennessee	19,870
Kentucky	36,025	Texas	29,487
Louisiana	7,630	Utah	111,034
Maine	2,337	Vermont	8,929
Michigan	73,874	Virginia	52,166
Minnesota	36,819	Washington	237,146
Mississippi	32,240	West Virginia	37,900
Missouri	46,571	Wisconsin	36,922
Montana	323,000	Wyoming	106,833
Nebraska	4,540		
Nevada	41,350	Total	$3,333,333
New Hampshire	32,706		

UNITED STATES AND EUROPEAN PRACTICES IN ROAD DEVELOPMENT

By THOS. H. MacDONALD
Chief, U. S. Bureau of Public Roads

THE PARTICIPATION of the delegates from this country in the VIIIth International Road Congress held in the Netherlands, and the subsequent inspection trips in many other countries of Europe, provided a broad comparative background of the results of national highway policies. This is not an advocacy that we should or should not be governed by or adopt the policies and methods of other countries; rather, that we should intelligently appraise the results of the cycles of time through which the older countries have gone as an invaluable experience from which we can profit sans cost. We must give heed to the fact that as the United States matures, we inevitably approach some at least, of the conditions apparent in the older countries. Just as the states which today are initially developing their major highways, are able to improve upon the work of the states which first engaged in constructing state-wide systems, and to avoid the deficiencies now apparent in these older systems, so as a nation we may take from the experience of these older countries very much more than technical details or methods developed under a wholly different economy. If we would profit from the centuries of experience through which these countries have lived, we must anticipate the trends that will best utilize the inherent possibilities of highway administration in reaching a more happy and more stabilized environment for the people of our own country.

Technical Development Widely Distributed

The technical reports submitted for reduction to conclusions which formed the basis for the discussions at the sessions of the Congress gave a very adequate cross-section of highway technical thought throughout the European countries. Problems of highway design and construction have a remarkably common international aspect. In the prepared discussions of the six general subjects programmed, including the standard types of construction, highway accidents, designs to segregate traffic, and soils, it is evident that the advances in technical development are now so widely distributed that there was an almost unanimous agreement among the countries upon the nature of the problems. A notable change between the discussions at this Congress and those of earlier years was in the harmony of interest of all the countries in the detailed problems of both cement concrete and bituminous road construction. In earlier Congresses there was a noticeable lack of interest by many European countries in cement concrete roads. Their attention was then fixed upon the bituminous types, stone sets, and the various macadams. This interest was reversed on the part of the United States. Now, due to the very wide adoption of cement concrete by all of the countries represented at the Congress, and the great increase in the use of bituminous materials by the United States, there is a notable agreement upon the problems remaining to be met in these fields. This is illustrated by the brief mention of specific problems recorded in the conclusions of the Congress.

German Design Is Reflected in the Helmstedt Bridge. Thin Section Concrete Arches

Specific Problems Recorded

For example:

"Joints are still the weakest feature in concrete road construction."

"Concrete surfaces laid since 1934 . . . have proved satisfactory . . . except . . . on bad subsoil."

"The use of dowels has increased."

"Surfaces of bricks, laid on sand without a prepared foundation, are not suitable for roads carrying fast and heavy traffic."

"The general use of iron block paving cannot, for the time being, be expected on account of its high first cost and the difficulty of maintaining a non-skid surface."

"Rubber surfaces are still expensive in first cost and will be limited to places where special value is attached to absence of noise and vibration."

"The inter-action between binding materials and aggregates especially as regards the displacement of bitumen by water needs special attention."

"Improvement and standardization of practical testing methods for bituminous binding materials, mineral aggregates, bituminous mixtures and the wider exercise of control testing in construction demand attention."

Doubtless these appear to be trite statements of common problems that add little to our knowledge. Yet, it is an international recording that we do not as yet have many details of design and construction perfected. It is a recognition that continuing scientific attention must be given to such details before we overcome known weaknesses. These are, as a class, typical of the questions that have long been with us.

Soil Problems in the Netherlands

Another class of subjects introduced, not for the first time, but as relatively new questions, on which there has been a great advance in knowledge recently, is designed to play very important parts in our developing technique. Representative of this class is the general subject of soils, now rapidly evolving as a fundamental science in its relation to highway construction. It was particularly fitting that this topic should be given major attention by the Congress in the Netherlands. Here is a country unique in the universal prevalence of soil problems without parallel in any other highly developed nation of the world. That large sections of the agricultural lands of the Netherlands have been reclaimed literally by push-

ing out the sea, is proof that the engineers have learned to cope successfully with soil and drainage problems. The securing of foundations on which to build even reasonably stable roadbeds has been further complicated by the existence of thick layers of peat which have been generally prevalent in the drained areas. In some cases where not too deep this peat is removed and replaced by sand fills to form the road embankments. In other cases where the thickness is too great to permit removal except at great expense, the embankments are built upon fascine mattresses. The dimensions of these mattresses are designed after careful determination of the bearing capacity of the soil. An extreme case of different and difficult road foundations is illustrated by the floating of a street pavement on bales of compressed peat, designed not on the capacity of the underlying soil but the buoyancy of the supporting material. It is easy to understand that any real progress in the development of durable roads in the Netherlands must be closely correlated with thorough laboratory and field tests of the soils involved. In addition to the Netherlands, important contributions to this developing science were made, in particular, by Sweden, Germany, England and the United States.

Accident Reporting

The indication that the highway officials are including in their field a much broader recognition of utilization problems was the careful consideration of the subject of accident reporting on such a basis that the results between countries will be reasonably comparable. The League of Nations has taken action to suggest the unification of the statistics of road traffic accidents, and the Congress adopted a recommendation to appoint an inter-

Limberg Bridge, Germany, Under Construction. Height Nearly 200 Ft. Above Floor of Valley

national committee to give further attention to a form of accident reporting that might be used universally. Certainly this is a movement which the United States can well endorse and support. Out of the discussions came a unanimous agreement that each road accident should be investigated and a record made of the locations, particularly as to frequency, for the purpose of determining if road conditions are a cause, and of formulating an emergency program designed to eliminate hazards thus disclosed.

An interesting discussion had reference to the light-reflecting characteristics of road surfaces, in which was pointed out the distinction between the light intensity of an illumination from fixed units and the light reflected to the drivers of motor vehicles from surfaces illuminated by headlights.

In both these groups of questions, the characteristics of which have been indicated by the examples given, it is evident that a very large amount of serious, well-trained laboratory research and field observations is being conducted by the highway administrations of the various important countries, their universities and technical schools. In general, the enlarged fields of scientific investigation and research related to highway transport have been somewhat later developed in the European countries than in the United States. There are some exceptions, and it will be profitable for the United States to keep close contact with the progress in the solution of technical problems which will inevitably follow the more intensive work now being done upon them.

Franzooenschlucht Bridge, Germany. Roadways on Different Levels Permit Unobstructed View of Country from Both Roads.

Relationship Between Nations and Their Highways

All that has preceded is largely introductory to the larger subjects from which it is possible for us in this country to obtain great value. These are not so much matters of the exact technical designs or construction methods, but the definite demonstrations of the fact that there comes a turning point in the relationship between a nation and its highways where a re-study, and based on this, a recasting, of highway policies are necessary. Out of the wholly new and very different undertakings which are under way in a number of the older nations, we are privileged to evaluate the conditions which preceded their determination, the methods employed in their execution, and the results which have been so far achieved. There are a number of general facts which must be remembered in comparing or contrasting conditions in other countries with those of the United States. In the European countries under discussion distances are relatively short, and population is relatively dense. Table I shows some of these actual figures. For example, on a national basis, the United States has 43 persons per square mile, Great Britain 510, and the Netherlands 674. The network of roads existing in individual countries was developed over centuries for the purpose of serving animal and foot traffic for short distances and at slow speeds. Because of the limitations of land, rights-of-way are generally narrow. The buildings hugged closely the sides and the daily activities overflowed into the roadways which were quite characteristically congested with all kinds of undisciplined, slow-moving traffic of man and beast. There was little conception of communication between the countries by highway. Upon these wholly localized highways was superimposed the motor vehicle, an antithesis in its character-

TABLE I—COMPARATIVE HIGHWAY STATISTICS

Country	Population in 1,000 Persons	Area in Square Miles	Persons Per Square Mile	Motor Vehicle Registration Passenger Cars	Motor Vehicle Registration Others	Ratios Vehicles Per Mile of Road	Ratios Persons Per Vehicle
United States	129,337	2,973,776	43.5	25,471,189	4,570,103	10.0	4.3
Great Britain	45,266	88,745	510.1	1,798,105	564,688	13.2	19.2
France	41,906	212,659	197.1	1,661,421	531,050	5.6	19.1
Germany*	73,376	214,068	342.8	1,240,033	372,079	6.2	45.5
Canada	10,377	3,466,556	3.0	1,104,150	201,989	3.2	7.9
Australia	6,706	2,974,581	2.3	517,430	232,323	1.5	8.9
Russia	165,847	8,095,728	20.5	65,096	449,344	0.3	322.4
Italy	42,764	119,714	357.2	321,322	118,672	2.9	97.2
Belgium	8,300	11,752	706.3	144,093	79,677	10.7	37.1
Sweden	6,250	173,347	36.1	134,296	57,651	2.1	32.6
Netherlands	8,557	12,692	674.2	93,545	54,360	11.7	57.9
Czechoslovakia	15,215	54,207	280.7	79,362	26,165	2.4	144.2
Norway	2,895	124,964	23.2	47,183	32,576	3.1	36.3

*Includes figures for Austria.

istics to every existing use of the highways. In the United States, on the contrary, a very considerable part of our more modern highway development has taken place after the motor car became not only the vehicle for which particular provision must be made, but also after it became the predominating type of highway traffic.

Segregation of Traffic

From this brief resumé it is possible to see why there is universal agreement among the European highway engineers that a first principle of highway design is adequate provision for the segregation of traffic. In this lies an important precept which, if accepted in our future work, will mean the meeting of the most fundamental of all of our highway problems. We do not face the bicycle traffic of Belgium or of the Netherlands, or the rural pattern of France where the population live in villages and night and morning fill the highways with horse-drawn traffic, stock going to pasture, and all the localized movement of agricultural implements incident to farm operations. We do not face the horse-drawn traffic of Hungary amounting now to perhaps 65 per cent of total traffic, even on the main roads. It is not necessary to burden the discussion with illustrations that reach the same conclusion. There is unlimited support for the basic principle that the highways must be designed to provide for all the activities in which people engage. We see in short focus and thus looming large, the motor vehicle, but there are also the pedestrian, the cyclist, and the animal traffic on our own highways. Even the motor vehicle must be considered in terms of local and long distance use. If we fairly look at all these aspects of highway use, there are no roads which do not justify that provision in the design be made for more than one type of traffic.

The Right to Pass

The more broadly we analyze highway usage in every country, the more surely we reach the conclusion that the early English conception of the highway is correct. The highway evolved not as a physical facility but as an inalienable "right of the individual to pass." This inherited tradition may account for much of the resistance to, and disregard of, traffic regulations today. There is a vast difference between requiring and compelling observance of traffic regulations.

In this difference lies the cause of many of our accidents. In European countries, which we think of as having greater regard for the law, those who use the highways certainly do insist upon the "right to pass" in every conceivable form of transportation, and to use the highways without any more consideration for other traffic than we show in our own country. It is apparent that this "right to pass" is a universal demand of the individual, and so the highway design cannot approxi-

The German Autobahn as Seen Through the Windshield of an Automobile

mate perfection until provision is made for every form of use that is a proper interpretation of this right. This does not mean that all types of use must be provided for within the limits of single rights-of-way.

The new special motor roads in the Netherlands include in the design two separated roadways for motor traffic, a bicycle paved path on one side, a wide pedestrian path also paved on the other, and at some distance removed, local roads adequately surfaced for land service and animal traffic. Here is a conception of a highway service that, complete in its component parts, may be used safely by all normal types of traffic, which quality should be reflected in many miles of highways in this country in the future. It may be urged that some of these types of traffic do not exist now in numbers to justify special provision for them, a valid objection as to the immediate need; but it is not the important point. The essential feature is the provision now for the land necessary for the development of each traffic facility when it is necessary. As our country matures and becomes more congested in population, we shall have the need for a combination of these or comparable highway facilities. This discussion permits a comparison as to the degree that the most advanced types of road building in a number of the European countries are meeting the requirements for universal service.

T. H. MacDonald, Chief, U. S. Bureau of Public Roads, Inspects Concrete Paving Operations on the Circular Road Around Berlin.

Heavy Grading on the Autobahn in Southwest Germany. Industrial Railways Are Used for Hauling Excavation.

Special Motor Roads

It may be thought from current news articles that appear from time to time that these countries have adopted a single type of super-highway improvement such as, for example, the German autobahnen. Such is decidedly not the case. Covering the period since the World War, the highway activity common to all the European countries has been the rehabilitation by reconstruction and modernization of a large mileage of the existing major highways. In some countries this program has been supplemented by beginning a system of special motor roads. The decision to undertake a system, limited or extensive, of special motor roads, was made after it became apparent that the existing highways could not be changed so radically in design as to serve fully the modern motor vehicle. Since we are in many states in the process now of attempting to rebuild existing highways to serve more adequately motor traffic, it is possible to obtain illuminating information from the actual experience in certain European countries. When we think of the problem of the United States to provide a mileage of roads adequate for the use of approximately 30,000,000 motor vehicles, it is important to get a conception of the extent to which other countries are projecting the special motor road type in ratio to the mileage of all roads.

Italy was the first country to undertake the building of a special motor road, termed an autostrade, a road built upon a right-of-way to which access from local roads was excluded, and all cross traffic carried over or under. This road was opened in 1924. In 1937 three hundred and ten miles of such roads had been constructed, of which the major mileage radiates from the City of Milan. The total approximates 3 tenths of 1 per cent of the public road mileage. The first road was built as a toll road, and as such has not proven a financial success. The conclusion drawn from this experience is that a subsidy amounting to at least half of the cost of the original construction is necessary before the financing on a toll basis can be assured.

France had as the original basis of its national highway system about 2,500 miles of the old Roman military roads. It is the single country that has proceeded for a century or more to improve a planned system of national routes. The Ecole des Ponts et Chaussees (Government School of Roads and Bridges) was established by Louis XV to train highway engineers. Napoleon I in 1811 established a system of imperial and departmental roads. For over a century no other country has compared with France in its systematic and competent technical administration of highways. For this reason the characteristics of the national system in location, in alignment and in other details are more nearly adapted to modern motor vehicle traffic than the existing roads of other European countries. So the main activities have been the post-war rehabilitation and the modernization of surfaces over a large mileage. In common with the trend in this country, it has been necessary for the Government to take a far greater financial responsibility in the rebuilding and maintenance of its principal highways, with the result that the national highway system since 1930 has been doubled in mileage and now totals approximately 50,000 miles.

Special motor roads have been planned and are under construction to the extent of 50 miles, all radial from Paris. On the basis of a total public road mileage of 392,000, the 50 miles constitute a minor fraction of 1 per cent. It is apparent that France, outside of metropolitan areas, will rely for a long time upon the modernization of its present highway system to serve its major traffic. But it must be accented that on account of its century-old policy of technical competency in the

Typical Bridge Construction Spanning a Narrow Valley on the Autobahn between Dusseldorf and Stuttgart

planning and development of its national system, much of the purely rural mileage can be brought to adequate modern standards.

The Netherlands has established plans for a relatively extensive system of special motor roads of about 932 miles, of which it has completed perhaps 60 miles.

England recently designated a national system of trunk line highways comprising 4,500 miles of existing principal highways. Surveys are being made in detail for the purpose of determining the work necessary to bring these to more modern standards. The ratio of motor vehicles to area is 26.6 motor vehicles per square mile, the highest in the world, and the congestion of population makes the acquisition of necessary lands for relocations and better alignment a super task. One of the prominent highway officials of England remarked that in any direction he started a new highway he ran head-on into a tradition. The present policy contemplates the modernization of present roads with by-passes around cities and narrow streets of villages, and the use of new alignments for sections. No special motor roads have as yet been planned.

The greatest interest of the highway world is now focused upon Germany. The undertaking of a spectacular national system of special motor roads commands attention to an extent that obscures the very comprehensive administration plan covering all roads, which the Third Reich placed in effect in 1934. The status of highway administration in Germany up to that time is quite accurately described as highly decentralized, with a marked lack of uniformity among the States and also among their sub-units—the provinces, counties and communes. The Reich itself exercised only certain rights of supervision, particularly with reference to police regulation, organized taxation and distribution of certain tax income among the States.

Centralized Highway Administration in Germany

The comprehensive program of administration of 1934 was predicated upon centralized control over all roads. An Inspector General of German Roads was appointed, who is directly responsible to the Führer and Chancellor. The man appointed to this important position, Dr. Fritz Todt, is a highly qualified engineer-administrator who most capably carries the great responsibility.

The plan for centralized administration provided these essential elements:

1. A reclassification of all existing public roads, approximately 169,000 miles, into four groups, with the special motor roads constituting a fifth class.
2. The establishment under the classification of a 25,500-mile system of main highways, termed Reich roads.
3. The construction of a system of 4,500 miles of special motor roads on new locations.
4. The financing by the national government of the Reich road system and the special motor road system.
5. The establishment of general supervision over all other roads under the direction of the Inspector General.

German Special Motor Roads

So much is necessary for the proper understanding of the relationship of the special motor roads to the German public roads. The conception is to provide for fast, long-distance motor traffic over arterial lines, and to improve existing main roads to supplement these and to serve local traffic. The lay-out of the system for the interior has been largely determined by the location of the 53 larger cities of the country, which are thus to be connected. But the idea is of much greater magnitude. Germany, on the authority of Doctor Todt, is recommending a great international highway system of comparable characteristics. The German planned system reaches the frontiers at the points best suited for the continuance into and through adjoining countries. The study for plans for a Berlin-Rome motor road is far advanced. Negotiations have been going on with the Netherlands, Belgium and Denmark to determine where the projected routes will join at the frontiers. Germany has enlarged the original undertaking to extend construction at once into Austria and the Sudeten area—so now, in place of 4,500 miles, the total projected is more nearly 7,500 miles. About 1,400 miles have been placed in service and operations are scaled to produce an optimum of 600 miles per year. Thus, a minimum period of ten years of high pressure construction activity is indicated.

The characteristic design consists of two roadways, each 7½ meters wide with an outside level curb 1 meter wide and an inside level curb about 1 foot wide—a total paved width for each roadway of about 28.8 feet. The roadways are separated by a center parking of 10 to 16 feet, but some variations are used.

Various views are expressed as to these roads. They are termed by some "military roads" but it must be remembered that a high military authority has stated that the system of roads best suited to serve the social and economic needs of a country best serves the military purposes. It is certain that a system of magnificently

German Motor Transport Passing a "Tank" Station

located special motor roads is being rapidly developed in Germany, which in all probability will be extended by and through the adjoining countries in course of time, thus forming a network of special motor highways serving all central Europe.

Typical Autobahn View with Grade Separation in Background

Summarizing

In summary, if we would profit from what we see now taking place in highway improvement, we must, through the use of the planning surveys, develop the systems of highways with the characteristics which are being found necessary or desirable after long experience in the countries of Europe that are giving greatest attention to the development of highway transportation. This means that, based upon the highway planning surveys, we must have first a reclassification of our highways; second, a provision for roadways and paths to serve all types of traffic that exist or that will certainly develop. The characteristics of the motor vehicle for fast, through traffic must be recognized, and this use

The Autobahn as Seen Through the Windshield of an Automobile

separated from the purely local use. Third, there must be the beginning of special motor roads in congested areas leading from the very hearts of our cities through the metropolitan areas, designed to permit free flow of motor traffic fully separated from other types, and all cross traffic. Fourth, at the other end of the classification, based on traffic density, is the big mileage of land service roads which must be organized and more rapidly brought to a continuously usable condition. Fifth, in between lies the program of State and Federal-aid systems on which work must continue with a constantly higher level of design standards to meet the traffic service requirements safely. Sixth, to accomplish these improvements a radically new policy of land acquisition must be formulated and put into effect to provide adequate space and to control unsightly and undesirable ribbon development.

These are only partial details of the future programs which are now made possible through the accurate data of the highway planning surveys, if these data are used intelligently to formulate the highway administration policies of the immediate future.

Acknowledgment.—The foregoing is taken from an address presented December 5 at the 24th annual meeting of the American Association of State Highway Officials.

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ROAD FINISHER EQUIPPED WITH FLOOD LIGHTS

Night and day shifts were worked last fall by the Wayne Paving Co. on its 2-course asphalt paving project at Benton Harbor, Mich., for the Michigan State Highway Department, in order to have the road open for

Road Finisher Provided Its Own Illumination for Night Work.

traffic before winter set in. The accompanying illustration shows the Blaw-Knox gas-electric road finisher equipped with flood light for the night work. The current for the light was obtained from the generator on the finishing machine.

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ASTM STANDARDS ON CEMENT (1938)

The 1938 edition of the special compilation of ASTM Standards on Cement, as issued by the American Society for Testing Materials, includes five specifications covering portland cement, high-early-strength portland cement, natural cement, masonry cement, and sieves for testing purposes. There are also given in their latest approved form the standardized methods of sampling and testing portland cement, chemical analysis of portland cement, compressive strength of portland-cement mortars, and fineness of portland cement by means of the turbidimeter. There is also included for information and to stimulate comment, a proposed draft of a method of test for autoclave expansion of portland cement.

In the manual on cement testing which gives helpful supplementary information on the standard methods there is provided a list of selected references on portland cement.

Copies of this 107-page publication in heavy paper cover can be obtained from the Headquarters of the Society, 260 S. Broad St., Philadelphia, Pa., at $1.00 per copy.

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$129 Automobile License in Germany.—In Germany the license fee on a car similar to a Ford is $129 per year. And if you travel over into Italy you will pay 72 cents per gallon for your gas.

LET THE ELECTRON EXPLAIN IT

By HALBERT P. GILLETTE

THE three great observational sciences—astronomy, geology and meteorology—abound in puzzling phenomena to such an extent that it seems as if some new principle of nature were needed to solve many of the puzzles and unify the whole. Perhaps the desired principle is merely one that will enable us to apply well-known laws in new ways. For example, suppose great pressure causes the conversion of more protons (positive charges) than electrons (negative charges) into radiant energy. Then every star and every massive planet would be a generator of electrons constantly shooting forth into space. The effects of such electric streams would obviously be multiferous and at times stupendous. Among the stupendous effects would be the slow death of a star here, the slow birth of another there, and a more rapid evolution of countless planetary systems such as the one whose center is the sun.

Our present conceptions of the nature of all stars would have to be completely revised. No longer would they necessarily be regarded as gaseous to the core and therefore as having inner temperatures of 30,000,000 degrees or more; for a molten core of relatively low temperature could exist by virtue of disruptive discharges of electrons through countless channels. Pipes thus opened in the core would release radiant energy at a much greater rate than could otherwise occur, thus lowering temperatures. Those "exploding stars" called novae would become understandable. And stars whose brilliance varies periodically could be better explained.

But we need not leave the earth to find an abundance of puzzles that this pressure theory of electron emission seems able to solve, if not in full at least in part. Take, for example, sea water. Why are its salts mainly chlorides while those of rivers are mainly carbonates? The answer is simple if electrolysis acts continuously and for centuries upon waters stored in the ocean or in lakes without outlets. Electrons coursing through such waters disrupt the carbonates, liberating carbonic acid gas which escapes into the air. These electrons, according to our theory, come both from the core of the earth and from the sun; and the latter probably are the main cause of such electrolytic action. In fact, they may cause lunar craters and assist in causing terrestrial volcanoes.

Volcanoes have become increasingly puzzling. Originally they were regarded as pipes that reached down to the earth's molten core. But when the study of earthquake waves showed that an entirely molten condition does not exist until a depth of about 2,400 miles is reached, a new theory had to be devised. The disintegration of uranium, with evolution of heat, was then seized upon as the answer to the riddle. But it fails to explain why volcanoes favor proximity to the sea, and why they do not favor regions where uranium is most abundant.

If the electron emission hypothesis be invoked, the salient features of vulcanism find easy explanation. Where cracks in the earth's crust occur near the ocean, and sea water enters them, escaping electrons flow through the water with greater ease than through the crust. This tends to divert the currents of electrons escaping under the adjacent land toward these channels, with a resulting rise of temperature in the conducting water. The hot water dissolves some of the adjacent rock, increases the ion contents of the water and thus increases its conductivity, thus diverting still more electrons into the aqueous channel. At great depths fusion of the rock occurs, with resulting absorption of water in the molten rock. Every isolated mass of water thus absorbed is an electrolyte that is liberating acid ions from its lower face and alkaline ions from its upper face upon the enveloping rock. Gases thus set free are forced upward, and reuniting at higher levels give off heat, thus causing fusion of rock up to the very surface. Actual combustion of such gases is to be seen in volcanic eruptions. Water is disrupted by this electrolysis, for hydrogen is at times found in abundance in volcanic gases. Escaping carbon dioxide, chlorine, sulphuretted hydrogen and the like testify to the intensity of the electrolytic processes below. And during eruptions violent magnetic and electric effects testify to the electric currents responsible for the electrolysis. Explosive eruptions have long been attributed to the rapid generation of steam, but why they occurred again and again in the same pipe was a mystery.

It is feasible to explain the lunar craters in much the same way, except that in their case the electrons that produced them were mainly of solar origin. The absence of water on the moon not only rendered craters less eruptive, but even prevented the formation of pipes of lava that overflowed. Their circular form may be explained as resulting from cylindrical "beams" of solar electrons.

Electrons in motion are magnets, and attract one another magnetically when moving in the same direction, with a force that varies with their velocity. Solar electrons that cause auroras often reach the earth within about 24 hours after a sunspot is on the central meridian. Hence, they travel 1,000 miles per second, and are powerfully magnetic. At times their velocity is much greater. Since each sunspot is a magnet, escaping electrons must spiral around the magnetic axis of a cyclonic spot and thus possess magnetic polarity. In addition they probably carry atoms from the sun, forming a core of magnetized matter in the spiraling electron-beam. Let such a high-speed electron-beam strike a globe, like the moon, and it would not only heat it, but magnetically and electrically attract lunar matter toward itself. If the matter were fluid, the cylindrical shell of solar electrons would build up a ring-shaped crater whose diameter would be that of the shell. Rotation of such a crater would impart stability to it, and give a magnetic polarity that would attract galactic electrons into the whirl, still further intensifying and stabilizing the whole.

I have previously called attention to geometrical progression series in the diameters of many lunar craters. Long prior to that Proctor had pointed out that these craters often occur in pairs whose diameters have a ratio of about 4 to 3; the larger one being more northerly; and that an uplifted ridge often joins the pair. Such a ridge can be explained by the electron theory. Similar phenomena may be seen on the earth, on a larger scale. Let me add that too many of the lunar craters have about the same diameter to be accidental. Finis Tycho, Copernicus, Theophilus, Archimedes and several other prominent craters are about 64 miles in diameter.

According to the electron emission theory, the lunar

FORMULA FOR BOND-*BURNING* CEREMONIES

Bond-*burning* ceremonies crop out in the news. It's a fine American custom—pleasant comment by civic leaders and happy "asides" among the taxpayers—as the torch is held to the cancelled bonds. And the pavement still good for years of service!

* * * * *

50 YEARS OF SERVICE

St. Paul, Minn., Virginia Ave., has completed a half-century of service. Neither weather nor traffic could best it. "It's still serviceable," says George M. Shepard, Chief Engineer, Dept. of Public Works of that city.

* * * * *

Baltimore, Md.—The oldest streets paved with brick still in use were put down 39 years ago, on a sand base. I rode over these early brick streets recently, and, considering that they were laid by builders of the abutting houses, I found them to be in good condition, except that the surfaces were somewhat wavy; but, no doubt, they will be used for a number of years to come.

I also inspected the first brick street laid on a concrete base by the City, under my supervision in 1901, around one of our public markets. Despite the heavy traffic, this street is in fair condition.—Frank K. Duncan, Asst. Chief Engr., Dept. of Public Works, Baltimore, Md.

A study of brick pavements in Des Moines by Iowa highway authorities concludes that service will average 36 years; Columbus, Ohio, reports over 500,000 square yards which has already averaged 45 years of service; records of individual pavements run still higher.

The costs of upkeep on brick pavements is very low—often ranges from negligible to nil. The reason: Brick resists damage from weather as well as traffic. As built today it gives a durably smooth, safe passage to any type of traffic. National Paving Brick Association, National Press Building, Washington, D. C.

BRICK

FOR NEW CONSTRUCTION OR RESURFACE JOBS

and terrestrial craters have had a similar origin. Their differences have served to camouflage their genetic identity. The same is probably true as to the solar whirls called sunspots and the terrestrial whirls called cyclones and anticyclones. If so, both of these superficially different phenomena are caused by the rotation of electrons around magnetic axes. But until it was pointed out that all great celestial masses probably emit electrons in excess of protons, there was no way by which the basic kinship of a sunspot and a cyclone could be fully established.

The most fruitful of all research methods has consisted in devising an explanatory hypothesis based upon a perceived analogy between two classes of phenomena. This method has not received the extensive use that it merits, for there is a congenital tendency to be too greatly influenced by the more obvious differences between the two phenomena. There is an even greater tendency to decry a new hypothesis on the ground that it has defects, forgetting that new hypotheses usually resemble new inventions, both requiring that much work be done upon them before they become very serviceable. For example, just 50 years ago Prof. F. H. Bigelow, upon advancing the hypothesis that the sun is a magnet, was met with the objection that great heat destroys magnetism. He replied that great heat had not destroyed the earth's magnetism, but the critics remained skeptical for 20 years until Hale silenced them with his spectroscopic proof that the sun is a magnet. Bigelow had seen in the curved streamers near the sun's poles what he took to be evidence of lines of magnetic force. A rather slight analogy, therefore, led him to a really great discovery whose truth would have been established much earlier had fewer astronomers been skeptical.

Bigelow also found a correlation between the latitudes of terrestrial cyclone tracks and the strength of the earth's magnetic field, whose variations he attributed to the sun. But to this day little attention has been paid to that significant discovery, largely because solar magnetism has been believed to be incompetent to produce the alleged effect. If, however, the sun sends streams of electrons in excess of protons to the earth, this objection falls as flat as the earlier one, namely that magnetism could not exist in an incandescent mass.

When a Columbus like Bigelow returns after a voyage of scientific discovery, he is usually met at the dock with no cheers, but in a silence that is vastly discouraging. Let him present his evidence that he has found a new principle, or has discovered a new way of using an old one to explain a phenomenon, and it is likely to be "taken with a grain of salt" by scientists too busy with their own problems to become much interested in his. Roemer found it so when he discovered that light has a velocity that he roughly measured. Schwabe found it so when he discovered the great sunspot cycle. Agassiz found it so when he discovered evidence of an ice age. Alfred Smith found it so when he pointed out that certain silt laminae, now called varves, were annual records of runoff. And so likewise a host of whom the scientific historian has written: "He was, unfortunately, far in advance of his day." So long as that sort of excuse for apathy continues to be offered, one may well doubt whether the age in which he lives is very scientific.

Scientific societies are commonly regarded as juries before whom each new scientific theory or principle is brought to trial and pronounced good or bad. Nothing could be much farther from the truth than such a conception. You will look in vain, for example, for any such pronouncement by a group of astronomers or meteorologists upon Bigelow's theories. He did not even have the satisfaction of a real fight in defense of them. Upon his death his necrologist said that he had been deeply embittered by the lack of interest in his researches. This was attributed to their mathematical nature, but so much of his theories was only slightly mathematical that this excuse for lack of interest is insufficient. His was the typical experience of researchers in the observational sciences. It calls for remedy still, as it has been calling for four centuries.

▼

MODERNIZATION OF FEDERAL-AID SYSTEM

The system of main highways in the United States is by far the most extensive of any in the world. Only the most out-of-the-way places cannot now be reached over a surfaced road. Many miles of main highways are broad, direct routes over which vehicles can travel continuously at the touring speed selected by the driver without the need for slowing down because of sharp curves, steep grades, or other obstacles and there is frequent opportunity to pass overtaken vehicles. However, there is a large mileage of roads that cannot be traveled with such facility and ease; roads on which the driver must accommodate himself to conditions that are definitely inferior to present-day standards.

This is a condition that has been unavoidable and that is being corrected as rapidly as the necessary funds can be obtained. When the states and the Federal Government began the improvement of highways the network connecting our cities was largely unimproved. These roads had been planned for horse-drawn vehicles and the pioneer automobilists made few long trips over them. That such a large part of the network of main highways can now be traveled with ease and comfort is due to the intelligent, long-time distribution of annually limited funds over a selected system. A degree of improvement was effected, which, though generally recognized as less than that which would ultimately be necessary, was still sufficient to serve the immediate need. As the need for further improvement of various sections has become evident it has been met as promptly and as fully as was consistent with the early completion of a desirable mimimum improvement of the system as a whole. This policy, sometimes called stage construction, is the only one under which the Federal-aid system and the more extensive state systems could have been improved in a short space of time to a general condition which permits their present use by a traffic of 150 billion vehicle-miles annually.

There are few sections of the Nation's network of main highways that have not been initially, if inadequately, improved. State and Federal appropriations, in large part, are now being devoted to supplementary improvements on the less adequate sections.

Many of our most used and important roads are among those that must now be classed as very inadequately improved. These are the roads that were first recognized as of outstanding importance and as such were first improved with surfaces of the highest type designed according to the standards of early road builders. There was general acceptance of these standards as sufficiently advanced—in fact, there was much opposition on the grounds that they were too advanced. The great increase in highway use and the recent marked increase in vehicle speed have forced the adoption of much higher standards.—From the annual report of Thomas H. MacDonald, Chief U. S. Bureau of Public Roads.

AMERICAN ROAD BUILDERS' ASS'N 1902

HIGHWAYS OF TOMORROW"

WHAT WILL THEY BE LIKE? HOW WILL THEY BE BUILT?

THE 36TH ANNUAL CONVENTION AND HIGHWAY EXHIBIT

of the

AMERICAN ROAD BUILDERS' ASSOCIATION

Presents

A WESTERN PREVIEW
TO INFORM YOU ABOUT

MODERN METHODS-MATERIALS-MACHINES

The Place **SAN FRANCISCO'S CIVIC AUDITORIUM**

The Time **MARCH 7-8-9-10, 1939**

Highlights OF CONVENTION PROGRAM

SPECIAL SESSIONS CONCERNING:

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- SAFE HIGHWAYS
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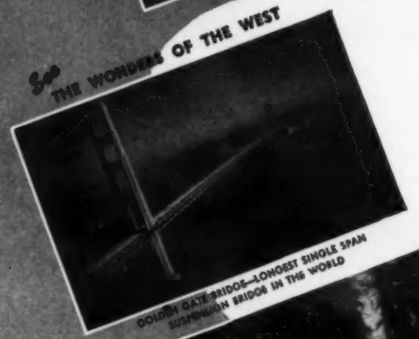

GOLDEN GATE BRIDGE—LONGEST SINGLE SPAN SUSPENSION BRIDGE IN THE WORLD

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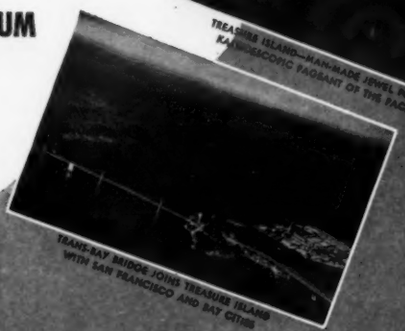

TRANS-BAY BRIDGE JOINS TREASURE ISLAND WITH SAN FRANCISCO AND BAY CITIES

SPECIAL TRAIN AND PLANE RATES TO SAN FRANCISCO WILL BE IN EFFECT.

MAIL YOUR HOTEL RESERVATIONS TODAY TO ARBA HOUSING COMMITTEE—EXPOSITION AUDITORIUM —CIVIC CENTER—SAN FRANCISCO.

PICTURE OF A ROAD [illegible]

Above: Roads like this mean expensive repair. [illegible] to trap snow on the road and cause surface [illegible]. One county says that Snogo paid for itself in [illegible] the cost of gravel for road repair.

Right: Snogo tossing snow banks into the fields. There will be no destructive drainage on to the road here!

ARS out of
INTS

WHEN the heavy snows come there is no time to be fooling around with blue prints and experimental snow-fighting machinery. When the blizzards hit, you want a proved machine—Snogo.

Behind Snogo is 12 years of successful operation in every kind of snow condition—12 years of constant improvement to meet every type of snow removal work—and 12 years of steadily increasing sales, repeat orders year after year. Repeat orders mean satisfied customers—satisfied users that have demonstrated and proved Snogo's reliability and economy. This is your assurance of dependability—your assurance that Snogo will meet the toughest snow conditions you'll ever have! Snogo cuts the cost of maintenance because it builds no banks to trap drifting snow. Snogo removes the snow completely, throwing it off the road, leaving the ditches open to do the job they were built for.

Snogo cuts away the deep side as easily as the low side of the drift. No danger of heaved up broken pavements because of uneven frost penetration. No hazardous one way bottlenecks with one half clear and the other half blocked to the center line. Snogo means better maintenance, lower cost maintenance, reduced road repair and greater safety—

And there is no better investment than Safety!

KLAUER MANUFACTURING COMPANY

Dubuque, Iowa

When there is snow to be moved, you will find SNOGOS—several hundred of them—moving it in

*Alaska	*Nevada	*Colorado	Wisconsin
*Canada	*Utah	*North Dakota	*Michigan
*Washington	*Idaho	*Minnesota	*Illinois
*Oregon	*Montana	*Nebraska	*Maine
*California	*Wyoming	*Missouri	*Virginia
*Arizona	New York	*Iowa	Connecticut

*Including state highway departments.

SNOGO

FOR COMPLETE SNOW REMOVAL

THERE IS A SNOGO FOR EVERY BUDGET!

Snogo is available in a wide range of models, from the lighter, faster and latest model LMU—a high speed winter maintenance unit for mounting on International 3 ton chassis to the mammoth model TU, for mounting on heavy duty four wheel drive trucks, and the big model F, the "Mountain Special" self contained on its own special chassis.

HERE and THERE—1938

These Five Pictures Show a Construction Project on Route 14 *on the West Shore of the Susquehanna River Near Harrisburg, Pennsylvania.* 1. *Dangerous, Sharp Curve of Underpass on Old Road.* 2. *Long Sweeping Curve of Three-Lane Pavement Cut Through Solid Rock.* 3. *Another View of Sweeping Curvature.* 4. *Gouging Away at the Mountainside; Clearing and Grubbing.* 5. *Spanning a Stream Enroute.*

WINTER MAINTENANCE IN ROCHESTER, N. Y.

By E. A. MILLER

Supervisor of Maintenance, Department of Public Works, Rochester, N. Y.

TODAY winter maintenance of streets insuring greater safety for both motorists and pedestrians, is one of the greatest problems confronting the Department of Public Works in all Northern cities, whether they be large or small. Other routine maintenance problems such as patching, resurfacing and street cleaning, are fairly well standardized according to methods that have been developed over a period of years.

This problem of the proper methods to overcome icy conditions on pavements has come to us within the last few years. The need has developed faster due to the demands of every one for highway safety.

A progressive city today must give to its motoring public the best protection possible during the winter months. In consequence, the Maintenance Section of the Department of Public Works of the City of Rochester has made a sincere effort to study the best methods and materials to be used to overcome slippery conditions and make driving safer on our streets in winter. Due to the results we are obtaining on our 450 miles of paved streets the automobile insurance rate here is less than in any other large city in New York State.

There is no doubt that the accessibility of the highway is a direct factor in store sales and the city's business in general. In Rochester we are in the snow belt where we must be prepared to meet a snow or sleet condition from November on through March and April and keep our streets clear so that business is not hampered by snow-covered or icy streets.

Street at Rochester, N. Y., Showing in Foreground Ice Removal by Rock Salt.

As in any business, proper equipment and materials are the only effective and economical means of combating our ever present winter problem of ice and snow.

Time is our most important element, in that proper application of effort at an early stage of a storm places us in complete control of the situation. We can not be caught unprepared because when a storm starts, it must be attacked immediately or else its damage to life and business is increased. Furthermore, if snow and ice are allowed to accumulate, equipment will not operate with as great efficiency and the total cost of clearing the city streets is much higher.

Here in Rochester we find that straight rock salt is the greatest single aid in our winter maintenance problems. It has been shown here that rock salt will, when properly applied, eliminate the building up of snow on the pavement into a thick mat of ice. Furthermore, the salt placed on the surface of ice will pit itself through the ice to the pavement surface, and the brine formed in the pit holes will run its way along the top of the pavement. This honeycombed action on the ice will cause it to be broken up under traffic.

For a light snow a mixture of rock salt and cinders is the most effective solution to our problem. We find that the salt will work through the snow to the pavement surface and the brine will not allow the packed snow to bond itself to the pavement. The abrasive gives the necessary wheel traction in the loose snow. We mix 100 lb. of salt to 1 cu. yd. of cinders.

In conclusion, all due consideration must be given to the great number of automobiles now in use. Consequently, we are making a diligent effort for further safety by seeing that the grades, important intersections, signal light and arterial stops, are kept as bare and as dry as possible during the winter months.

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FEDERAL LEAFLET DISCUSSES DAMAGE FROM WATER RUNOFF

The damage which runoff water may cause to highways and adjacent farmlands is discussed in a new publication of the United States Department of Agriculture. The author, Arnold Davis of the Soil Conservation Service, points out that highways cannot always follow natural slopes and often intercept the natural flow of water.

When intercepting highways and highway ditches are not protected against washing, deep gullies frequently develop. These often eat into the roadbed and into adjoining farmland. Pictures in the new publication—Leaflet 164—show how eroding water increases road maintenance costs by cutting embankments, damaging shoulders and retarding drainage with silt and erosional debris.

The Bureau of Public Roads, the Soil Conservation Service, and most highway dpeartments are cooperating in developing erosion safeguards for the right of way as well as for adjacent lands.

Leaflet 164 may be obtained from the U. S. Department of Agriculture, Washington, D. C.

BETTER LINE MEASUREMENTS

By F. O. NELSON

Engineer and Surveyor, Toledo, Ia.

The most prolific source of errors and inaccuracies in measuring land lines, aside from plain blundering, is uneven topography. The usual method of getting horizontal measurements on slopes is by holding up the down slope end of the tape and plumbing it over a point. This method is slow and difficult over hilly ground. Its accuracy is much limited by the cost and by the help available.

Much more use should be made of the transit, equipped with vertical circle, or other means for finding the rate or amount of slope and corrections made on measurements which follow the slope. Both speed and accuracy are gained and much less skill demanded of the chainmen. This system becomes particularly appropriate when inexperienced or non-expert help is used, and on windy days.

It is generally not hard to spot or place marks the same height above ground as the instrument stands, determine the degree of slope by sights on them and use tabulated corrections for short and safe computations. Tables for this use should have at least three columns; showing (1) degree of slope, (2) horizontal equivalent for 100 ft., or other unit, along the slope, (3) vertical difference. Sometimes it is more convenient to take vertical measurements than degree of slope and the table answers for that, too.

Tables made on tracing cloth the size of a page or two of the field book, blueprinted, and a copy inserted in the book are desirable. Interpolation is easy if only even degrees are tabulated. Stadia corrections and other commonly used data to suit the individual need can be placed on the same sheets.

Leveling of the tape need not be abandoned entirely. Short breaks, like ditch banks are more easily handled that way. Careful stadia measurements across streams and across extremely rough ground may often be used to advantage, though uncertain for long distances when the air is so heated as to cause refraction.

▼

NORTH ATLANTIC STATES CONVENTION

On February 15, 16, and 17, 1939, the Association of Highway Officials of the North Atlantic States will hold their fifteenth annual convention at the Hotel Pennsylvania in New York City.

The program committee has arranged for the presentation of a number of highly interesting topics, featuring "Safety" at the Wednesday afternoon session, February 16th; "Design and Construction" at the Thursday morning session, February 17th, and "Maintenance" at the Thursday afternoon session. The Friday morning session will be devoted to subjects of general interest. The opening session will, of course, be held on Wednesday morning, February 16th. On Friday afternoon those attending will be afforded the privilege of a preview of the New York World's Fair.

▼

ETHIOPIA ROAD CONSTRUCTION. — The first 450 kilometers of the great south main highroad in Italian East Africa is now under construction. It will be surfaced with asphalt. Over 4,000 Italians and 7,000 Somalis are employed on the work, which is expected to be completed in about 5 years at a cost of about $30,000 per kilometer.

From Our Readers

HIGHWAYS AND NATIONAL DEFENSE

Mr. Victor J. Brown,
Publishing Director,
Roads & Streets,
330 South Wells Street,
Chicago, Ill.

Dear Vic:

You have no doubt noted the indication of a linking of the National Defense Program and the WPA in the news comments concerning the President's promotion of Col. F. C. Harrington from Chief Engineer to Administrator of the Works Progress Administration, to succeed Harry L. Hopkins.

Naturally no one knows at this time just what part of the national highway system would be considered as national defense or come under some relief agency but in view of the fact that the Bureau of Public Roads was not mentioned in any of the fourteen national highway bills proposed during the last session of Congress, I am wondering if this may not be some ground work along the same line for a national highway coming under some relief agency without any connection with the Bureau of Public Roads.

There should be no serious objection to a national defense program being linked in part at least with relief. There would, however, seem to be many reasons why a national highway or a national defense program insofar as it was related to highways, should be worked out with our national highway organization and fit into our already existing system.

With the proper cooperation between those in charge of national defense and those already familiar with peace time traffic problems, a highway could be designed and built which would serve modern military and peace time traffic equally well. This would give a large part of the military features a definite economic value and such a highway would pay for itself in peace time service long before it had become obsolete as a unit of national defense and likely before it had been used for that purpose.

For example, consider just one of the problems in connection with the defense from the air. During the war scare last summer, London blocked off sections of her subway system in which people were to be crowded in the case of an air raid. This congestion would bring about many difficult problems, including sanitation and ventilation. Consider the effect if a gas bomb were to strike at a ventilation intake. It would seem much better if these people could be quickly scattered over large areas.

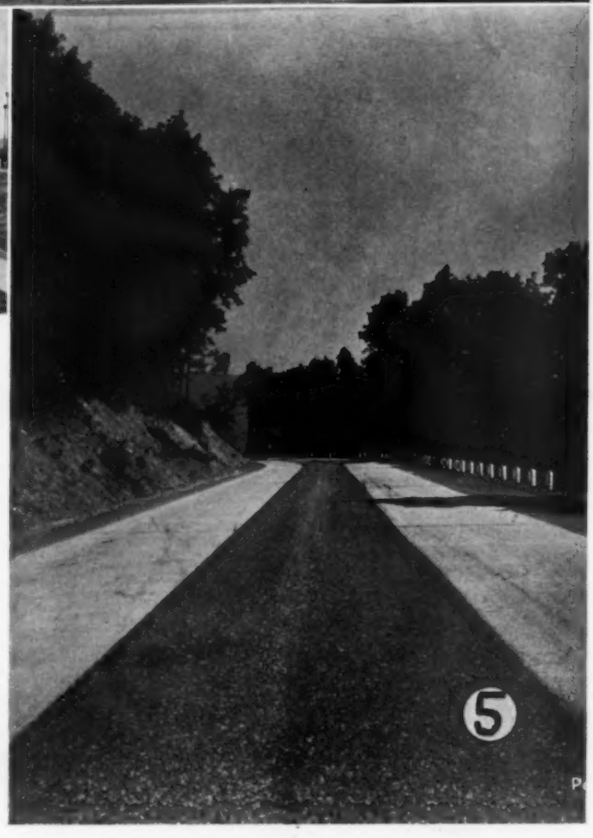
This may be a rather difficult problem in the case of most large European and Asiatic cities because of the lack of transportation facilities but that should not be so here. Take Milwaukee with a population of about 630,000 for example. The 1937 registration showed 153,000 cars or one for each four people. The entire population could be moved out in one load. Naturally there would be many detailed problems not considered here but this illustrates what could be done with available peace time equipment, using highways which would have a definite peace time economic value.

I do not know what effect political influence will have, but outside of that it would seem that such a combination of economic and national defense features as affecting highways would help greatly in obtaining the necessary appropriation, benefiting those charged with national defense as well as the highway construction industry.

This is a thought that went through my mind as I read the news comments and I pass it on to you.

Yours very truly,
JOHN W. POULTER,
Research Engineer,
Koehring Company,
Milwaukee, Wis.

HERE and THERE—1938



1.—*Reinforced Concrete Bridge Over Waccamaw River at Conway, South Carolina. It is 1058 ft. Long. Note the Heavy Concrete Handrail.*

2.—*Paving Two 20-ft. Concrete Lanes, Separated by a 30-ft. Parkway, on U. S. 40 in St. Louis County, Missouri, Using a 34-E Dual Drum Paver.*

3.—*View Below U. S. 40 Superhighway Viaduct in City of St. Louis, Missouri, to Show General Design.*

4.—*Completed Railroad and Highway Grade Separation Project in Ames, Iowa. View Taken from North.*

5.—*Long Sweeping Curves Identify New Construction of Pennsylvania Department of Highways. New Three-Lane Highway Along West Shore of Susquehanna River Near Harrisburg.*

EDITORIAL

AIDS FOR NIGHT DRIVING

UNDOUBTEDLY the best contribution for the reduction of traffic accidents that the engineer can make is to design for safety with speed. However, traffic lining and signing aids will also offer a large measure of aid when coupled with education and enforcement. The center line of a highway is truly a "life line." Likewise reflector buttons placed in a continuous row and luminous discs and paint are life savers.

It is common knowledge that we fail to see the center line stripe when the glare of an approaching vehicle's headlights strikes our eyes. Most of us, under these conditions, follow one of two procedures in passing the glaring headlights approaching. Either we watch the right hand edge of the pavement or we try to gauge our position in passing by judging the distance we allow between our own vehicle and the approaching headlights. Both of these methods are unsatisfactory. How many accidents are attributable to this condition we do not know, but if only a few of them could be prevented the medium employed to bring about the reduction would be well worth while.

We have observed striping in which small glass beads were embedded in a paint-like binder, that became pearly luminous when the headlights struck the stripe. We have seen highway signs treated with the glass bead surfacing that were highly luminous from every angle up to nearly 180 degrees. Night drivers will appreciate this when they recall that they have been unable to read a sign at the moment they so desire, because of glare from the paint. At this precise moment they are probably traveling 50 to 60 miles per hour and at the moment they are close enough to a sign to read it, the wording is obscured by a glare. Glass bead treated signs were readily readable.

The built-in, wide, white-concrete stripe on the centerline acts as an invisible barrier against crossing into the wrong lane.

Many signs are greatly improved with reflectorized buttons. These buttons on culvert headwalls, guard rail posts, railroad crossing markers, center piers of underpasses, and other obstructions have proven extremely valuable night driving aids. In places we have noted red reflector buttons of large size on curves and pavement edges that have been particularly effective. They are either embedded in the curve or mounted on posts on the shoulder.

In several places in the United States we have seen headlight luminous discs or plates mounted on posts about 4 ft. high spaced about 150 or 200 ft. apart along both shoulders of a highway. They define the shoulder line and are visible for hundreds of feet ahead. Subconsciously, these reflecting plates or discs create a feeling of safety in night driving.

Then, of course, in many places we have seen the luminaire of sodium light that lights the highway for continuous long stretches, as well as at dangerous intersections or other danger points.

All of these aids have distinct value for the night driver. Night driving safety challenges the highway engineer. Undoubtedly increased attention will be focused on the various ways and means for improving the safety of night driving.

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BETTER ENGINEERING

THE more I work with and talk with road and street engineers, federal, state, county, or city, the more I am convinced that the civil engineering profession, highway engineering division, should have a professional college of advanced civil engineering practice, theory, and design. Particularly advantageous would be classes in mathematics, logic, economics, and construction management. The highway engineer needs such a national academy. Precious little do road and street engineers remember of their college mathematics. Very seldom do they use or even understand anything more complicated than simple algebra, especially 10 years after they graduate. Mathematics being the only common international language, engineers should be proficient in its use and in the employment of mathematical tools.

Just how such a super-school or engineering clinic would be established, I am not prepared to say. I believe, however, that if the U. S. Bureau of Public Roads were to undertake the founding of such an enterprise, that it would meet with explosive success. I can clearly recall the value I received out of a period of instruction spent at the Coast Artillery School. Advanced military science and tactics were taught which I absorbed much more easily than I did at college or during the war.

Road and street engineering has developed so rapidly and is continuing to develop so rapidly that practicing engineers find it difficult to keep abreast of new research and theory. Higher mathematics, logic, and economics are so closely interwoven with these new developments that engineers should be more capable in their understanding and employment of these related sciences. Such a super-college or academy should be available at reasonable cost to all road and street engineers desiring more complete technical knowledge. Courses of study could be programmed at regular intervals by engineers of the U. S. Bureau of Public Roads and other engineers of civil subdivisions receiving federal financial aid for road work could keep abreast of the newer theories by attending their organized classes.

The setup for financing road and street work in the United States lends itself admirably to the successful functioning of a National Highway Engineering Academy. It would be a simple matter to require engineers who have jurisdiction over road or street work on which federal aid is given, to attend a 3 months' course of advanced highway engineering. The money expended by the federal government on such a project would pay huge dividends in economic construction and sound design.

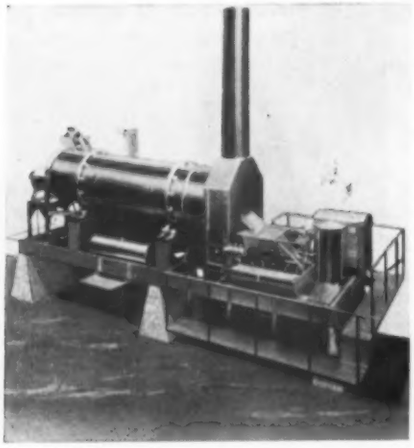
A National Highway Engineering Academy would directly mitigate for higher standards in highway administration, design, and construction.

It would be entirely logical and advisable for the Technical Division of the American Road Builders Association to establish a committee to study this proposition, jointly with the Highway Research Board and the American Association of State Highway Officials.

NEW EQUIPMENT AND MATERIALS

New Asphalt Plant

A new asphalt plant of moderate capacity, especially designed for large maintenance or small production work is being offered by the White Manufacturing Co., Elkhart, Ind. This illustration shows the Model L-12, which has a capacity of 12 tons per hour, with conservative rating. It has an aggregate dryer 46 in. in diameter by 15 ft. long, equipped with cascading shelves and also center cross flights which considerably increase the amount of hot steel on which aggregate is dried. Dryer is equipped with inspirating type low pressure oil burner and exhaust stack. Because of the type of burner and the size of the stack, no exhaust blower is necessary. It is stated temperatures of discharged material can be as high as is practical for bituminous work. In this plant



New White Model L-12 Asphalt Plant

material is fed to the dryer by an elevating loader which is part of the unit. Model L-12 is regularly equipped with volumetric measuring devices which accurately comply with formula. The plant can be used, however, with standard bins and weigh scales. In the picture are shown the dryer discharge to volumetric measuring hopper, pug mill underneath, bitumen measuring trough. The discharge chute from dryer, the measuring hopper and pug mixer discharge gates are all air-operated. Unit is equipped with 300 gal. bitumen heater with oil burner. This model as shown is driven by a Continental engine, and has a LeRoi compressor. It can also be furnished as a portable machine on pneumatic tired wheels. Its weight is 21,500 lb. A similar model is made which has capacity of 25 tons per hour.

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Portable Gravel Plant Produces Rock Chips as By-Product

With the increased mileage of black top roads, there is an increasing demand for rock chips for the seal coat. To meet this demand, the Pioneer Engineering Works, Inc., Minneapolis, Minn., have designed a

Pioneer Portable Gravel Plant Installation

screening arrangement for their vibrator duplex crushing plant that will produce these rock chips as a by-product simultaneously while producing road gravel. This means that the Pioneer user can produce rock chips for the seal coat at the same time that he is producing his base course. There is no waste material as the crusher dust is screened out of the chips and mixed with the road gravel. There is no additional expense as no extra screens or equipment are required. The crushers are not closed down any closer so that the total production is not curtailed. The Pioneer vibrator duplex crushing plants use the bottom deck. Thus the bottom deck screens the pit run material only. The top deck screens the crushed material only. In this screening arrangement, the pit material and the crushed material are not mixed together. Chip spouts are provided to deliver the chips onto a belt conveyor.

▼

New Bucyrus-Erie Snow Plow

Equipment which converts the Bucyrus-Erie bullgrader or bulldozer to a heavy duty snow plow by changing only the blade and frame has been brought out by Bucyrus-Erie Co., South Milwaukee, Wis. The snow plow is a V-style with adjustable wings and full hydraulic control . . . heavy duty in every respect . . . capable of handling any snow, according to the manufacturer . . . yet quickly convertible to a bullgrader or bulldozer for year 'round maintenance and earth moving use. Snow plow and bullgrader or bulldozer are mounted on the same T-40 International TracTrac-Tor, use the same hydraulic pump, the same

Bucyrus-Erie Snow Plow.

hydraulic cylinders, the same control valve and the same attaching parts. Convertibility is simply had by removal of the bolts that hold the bullgrader or bulldozer frame and blade in place. Then disconnect lifting rods, back out and run tractor into the snow plow frame, bolt the same connections and the plow is ready. The plow will fit either standard or wide gauge tractor with any width track shoe available. The hydraulically-controlled plow, mounted on an International T-40 or TD-40, is built to handle all snow depths. For light snows, speeds up to 6 m.p.h. are available, and by using both plow and wings at ground level a path as wide as 18 ft. can be cleared. In slightly heavier snows or on wide roads one wing can be raised and used to wing snow back to the ditch while the opposite wing can be held at ground level for extra plowing width. The wings have a ground clearance of 6 feet at full height . . . easily clear mail boxes, fence posts, etc. For heavy drifts, the plow, which clears a 9 ft. strip, may be used without wing structure or wings can be folded back or used for winging snow on either or both sides of the road. Adjustments of wing or plow heights are made instantly without leaving the cab. The Bucyrus-Erie winter cab for the International T-40 and TD-40 is specially designed for snow removal work. Windows on all four sides insure full visibility and, because ventilation can be changed to meet varying wind directions, operator comfort is assured all the time.

▼

New 1½-Yd. Lorain-79

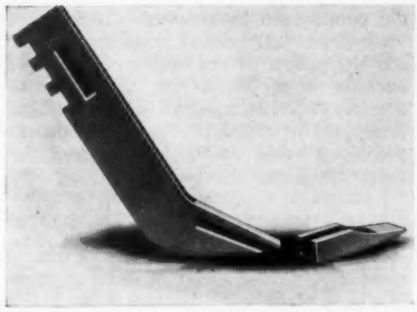
The Thew Shovel Co., Lorain, O., has announced its new model, the Lorain-79, a newly-designed 1½-yd. unit convertible to shovel, crane, clamshell, dragline, or backdigger service. The new machine is mounted on a newly designed chain drive, crawler 13 ft. 8 in. long 10 ft. 6 in. wide. The crawler is equipped with 24 in. wide treads, with other treads available in 28 in. and 34 in. widths. The crawler has two travel speeds, 1½ M.P.H. and ¾ M.P.H., available in either direction. All the propelling and steering mechanism of the crawler is located in a central steel carbody casting or gear box. All the op-

The New 1½ Yd. Lorain-79.

erating mechanism is protected against mud, dirt and water by an oil tight gear case. The steering clutches slide on splined shafts, and permit steering in either direction. Another feature is the locking and safety ratchet and pawl on the horizontal propelling shaft. This consists of the ratchet wheel with two pawls, one on either side of the ratchet, each independently operated. On level ground four combinations of locking are ratchet are possible. Another feature of the crawler is the elimination of any rollers or idlers along the top to support the top of the crawler tread belt. Instead the top tread belt is supported on a full length T-rail. Thus the treads slide along a horizontal surface fully supported, and as a consequence there is no buckling or "clanking" of treads. The Lorain-79 is supplied with an all-welded shovel boom 23 ft. long from hinge pin to boom peak sheave pin. The two boom side members introduce a new design feature in that each is a built-up steel tube of rectangular cross section, entirely electric welded into a unified structure. The dipper stick is also an all-steel, all-welded construction of rectangular cross sections. The only use of bolts in the boom is in the attachment of the crowd rack sections to the bottom of the dipper stick. The rack is made in short sections of drop forged, heat-treated steel, bolted in place to provide ease and economy of replacement of the rack section. The dipper stick is actuated through an independent chain crowd acting through a hinge pin drive. The turntable of the Lorain-79 is built to the Center Drive design. In this design, the power is taken from the six cylinder Diesel motor and is transmitted through a silent chain drive to the Center Drive. The Lorain-79 is a fully convertible unit. As a shovel it is equipped with 23 ft. boom, 18 ft. dipper stick and 1½ yd. dipper. A special stripping boom 25 ft. long with a 25 ft. stick and 1¼ yd. dipper is available. Its capacity as a crane is 25 tons at 12 ft. radius, equipped with booms from 40 ft. up to any desired length through the medium of insertable center sections. Crane and dragline booms and equipment are also avaliable. The backdigger boom features a 24 ft. tubular boom with a 10 ft. 6 in. dipper stick. Dippers come in 31 in. to 42 in. widths and are of the controlled tilting type, whereby the operator has control of the digging angle and dumping position of the dipper at all times.

Scarifier Teeth With Renewable Points

Scarifier teeth with renewable points of special alloy steel are now being offered by the Caterpillar Tractor Co., Peoria, Ill., for all its auto patrol scarifiers and for all its blade grader scarifiers (except No. 66). These new teeth take the place of the one-piece teeth, and with them only



Scarifier Teeth with Renewable Points.

the points need be renewed. It is stated these points last several times longer than one sharpening of ordinary teeth. Only a hammer is needed to put on or remove points. A slight taper fit holds the points firmly to the shanks. The points do not loosen or come off in heavy service or from vibration.

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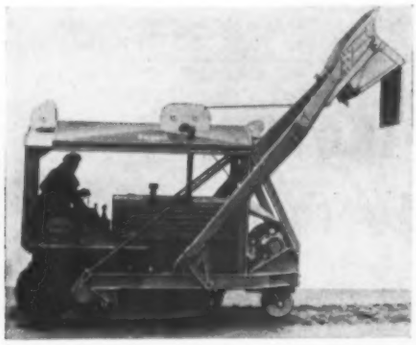
New Tractor Shovel

A new overhead shovel, a tractor attachment for moving earth or loading snow, has been placed on the market by Maine Steel, Inc., South Portland, Me. By the



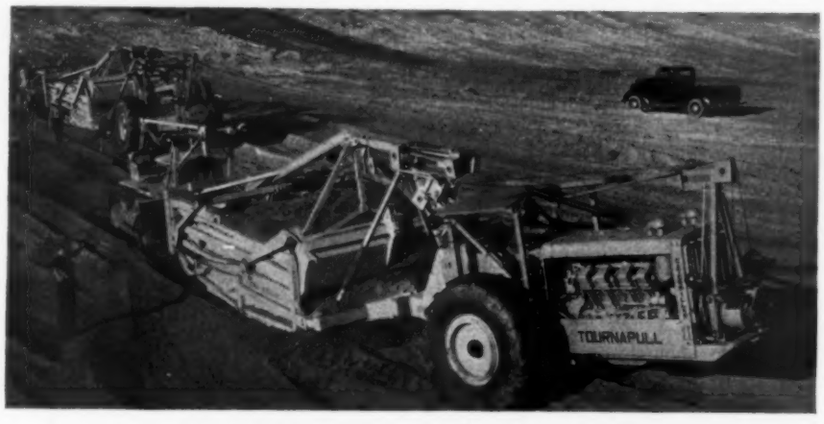
The Sargent Overhead Shovel with ⅜-yd. Bucket, in Dumping Position.

addition of an interchangeable group of comparatively inexpensive accessories, a standard crawler tractor, with a single operator, has the versatility of several separate machines. In its primary shape the overhead shovel is a fast and effective dirt shovel, capable of hard digging. The smallest shovel for earth excavation is ⅜ yd. Larger sizes are provided for light materials and for larger tractors. It is not necessary to turn the tractor to load into trucks. A bulldozer blade with down pressure can be hooked onto the shovel in 15 minutes. It can be changed to a snow loader in half an hour. It can be used as a tractor without removing any of these accessories. When used as a dirt shovel, it is equipped with a cast alloy steel bucket shell, with digger teeth that will stand hard digging. It gets its "crowd" by backing the tractor. When filled, the bucket is hoisted straight up over the tractor and dumped in front by tripping a hinged cover. It can load into high trucks.

▼

Self-Powered 30-Yd. Scraper

A 30-yd. self loading scraper, the Tournapull—stated to be capable of making fast truck speeds under its own power, has been brought out by R. G. LeTourneau, Inc., Peoria, Ill. The unit is powered by a 160 H.P. "Caterpillar" engine, whose nose extends unsupported in front of the 80 in., 2-foot tread pneumatic tired drive wheels. The weight of this overhanging motor is counter-balanced by the weight of the carrying unit and the load in the rear. The entire weight of the engine together with much of the weight of the load is placed on the two large drive wheels to give the greatest possible traction per pound weight. The Tournapulls are steered much like track-type tractors—by independent control of each wheel. However, they have an additional feature not found in conventional tractors. One wheel may be held stationary and the full engine power transmitted to the other. Interchangeable hauling units have been designed for the Tournapull—the Tournatrailer and the large carryall scraper. The Tournatrailer is a 30-yd. rear dump buggy consisting of a bottomless body sliding over a fixed bed. In dumping, the body—cable controlled—moves back over the bed, scraping the load with it, and drops the material through the ever widening gap at the rear. The second unit is the U-type, double bucket, 30-yd. carryall scraper adapted for Tournapull usage. The Tournapull and carryall combination is a self-loading unit. Twelve Tournapulls are now being operated on the 12,000,000 cu. yd. Hansen Dam project, near San Fernando, Calif.



The 30-yd. Self Powered, Self-Loading Scraper.

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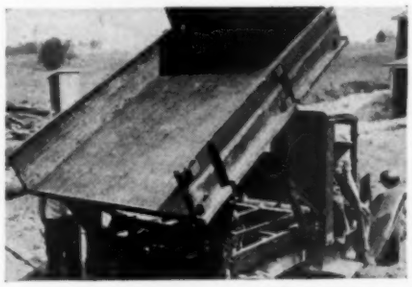
New High-Lift Truck Bodies

A new line of high-lift truck bodies hydraulically operated has been announced by the Kewanee Manufacturing Co., Kewanee, Ill. Two types are available, both the high-lift hopper body and the high-lift dump, the latter constructed with flat bottoms and available for various dumping angles from 30 degrees to 50 degrees with clear dumping heights of from 5 to 7 ft. The particular mechanism shown has been in daily operation for over a year and exemplifies a new type of con-



Truck with High Lift Hopper Body

struction with some unusual features. The subframes, constructed as an unit may be mounted on any make of truck without alteration. Hydraulic cylinders attached horizontally to this subframe operate on bell cranks to translate the horizontal movement to vertical movement. The relationship of the various parts is such that the oil pressure remains constant during the stroke. This results in very smooth easy motion, in fact the manufacturer contends that no speeding up of the engine is needed for hoisting but that the operation can be accomplished with the engine at idling speed. Twisting strains while hoisting or in transit cannot be transmitted from the chassis to the operating mechanism. The hopper bottom job can be had with clear dumping heights as high as 8 ft. 8 in. and capacities up to 10 tons. The elevated dump truck body is available in capacities up to eight tons.

New Refuse and Garbage Unit

A new garbage and refuse unit having an all-enclosed body has been placed on the market by Gar Wood Industries, Inc., Detroit, Mich. The unit compresses, like a hydraulic baler, all kinds of bulky rubbish and garbage into a compact mass, full-capacity load that is much greater in weight than the usual loose load. When the load is compressed, water and other liquids are squeezed out, making the refuse and garbage burn quicker, thereby effecting economy at the incinerator. The load-packer can be built in various lengths, widths and heights to fit any truck or trailer chassis. The loading trough located close to the ground, simplifies loading by shovel or from baskets and cans. The garbage and rubbish are not exposed and odors are confined. Papers cannot blow off. Every available cubic foot of the body can be filled. The body can be cleaned easily. A Gar Wood hydraulic hoist dumps the load in the conventional manner. Another set of cylinders opens the endgate to give ample clearance. A retainer plate keeps garbage already packed from falling back into the trough. This retainer plate is released and snaps back against the packing plate at the instant the lever operating the compressing ram is moved. When the trough is filled the loading doors are closed and locked, becoming part of the tail-gate ram. The valve-operating lever, at rear of the body, is then moved and the two compressing jacks thrust the ram, the packing plate and the retainer plate, against the garbage in the trough, cleaning it out completely and packing it solidly into the body. The packing plate and tail-gate ram are then returned to their starting position while the retainer plate is held in position by an automatic catch. Loads are compressed by means of two hydraulic cylinders which operate the ram. This action also cleans out the trough in readiness for another filling.

New All-Enclosed Gar Wood Load Packer.

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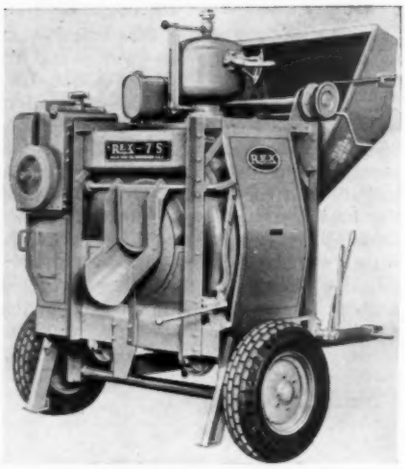
New Line in Concrete Mixers

A complete new line of Rex concrete mixers in the 3½-S, 5-S, 7-S and 10-S sizes has been announced by the Chain Belt Co., Milwaukee, Wis. The Rex 5-S is made in a two-wheel end discharge and a four-wheel side discharge style and is powered by a 6 H.P. single cylinder air cooled engine. The 7-S is made in a two-wheel end and four-wheel side discharge model and has the optional power of a one-cylinder air cooled or a four cylinder air cooled engine. The Rex 10-S mixer is made in a two wheel end discharge, four wheel end discharge and a four wheel side discharge model powered by the standard or heavy duty four cylinder engine. All these mixers can be furnished with steel, solid rubber or pneumatic tired wheels. All can be equipped with the new Rex batch meter and the new Rex self-priming centrifugal water pump. These new 1939 Rex mixers are streamlined for fresh modern appearance and are painted bright Persian orange for better prolonged appearance in the field. The 5, 7, and 10-S mixers use the conventional type mixing drum—the Rex modern drum of rugged all-welded construction with pressed steel drum heads and center strip welded together to form a stronger, lighter and more perfectly balanced drum. The mixing blades and buckets are made of high carbon steel to resist abrasive wear and retain their height and shape to assure proper mixing action. The Rex modern drum rolls on pressed steel drum rollers which are light in weight and are not subject to soft spots. Each machine has full view one man end controls to enable the operator to handle both skip and discharge without moving from his station. Each has the Rex shimmy skip—the patented shimmy shaking action which hurries the stickiest batches down the streamlined skip into the drum. This skip action is produced in such a manner that there is no pounding on the cable and no countershaft wear. The Rex discharge chute which re-

mains completely outside of the drum opening while mixing is taking place is swung into the extra large drum opening only for the discharge and consequently there is less wear and longer life in the Rex chute. All have the new Rex water tank which together with the Rex non-By-Pass valve meets water specifications for all mixes—anywhere. The new 5, 7, and 10-S machines are all driven by genuine all steel Rex Chabelco chain with case hardened pins and bushings, heat treated rollers and sidebars. The 3½-S tilting mixer retains its present design with a number of refinements. The front foot is adjustable horizontally to enable the machine to remain in a true upright position even though standing on uneven ground. The towing tongue is of a new telescopic design which clicks firmly into place in towing or mixing position. The tilter retains the fast efficient mixing action of the three blade drum, the modern power, the Rex Griplock chain drive, the Timken bearing drum drive pinion shaft, the Timken tapered roller bearing spindle, and the riveted all-welded all steel frame. This new 3½-S with its streamlined appearance combines eye-appeal with new design and construction.



New Rex 7-S Concrete Mixer.

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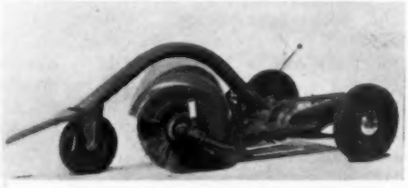
New Traction Driven Road Sweeper

A new traction driven road sweeper, designed to meet the needs of road contractors, county and state highways for an inexpensive road sweeping machine, has been added to the line of the Frank G. Hough Co., 919 North Michigan Ave., Chicago, Ill. The unit is equipped with a 7 ft. brush which is 30 in. in diameter. The brush



New Hough Traction Driven Road Sweeper.

is adjustable as to ground pressure and to the crown of the road. The power for driving the brush is taken from the left rear wheel and transmitted to the brush through a three speed standard automotive transmission which runs in oil and is fully enclosed in a dust proof case. The brush may be operated in either of the three speeds by merely shifting the gear lever into the proper position. The machine is equipped with a tow pole easily hitched to either a truck or tractor.

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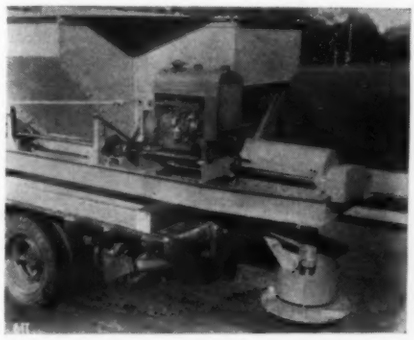
Sand Spreader Powered by Gasoline Engine

A sand or anti-skid mixture spreader equipped with an independent power supply has been placed on the market by the Good Roads Machinery Corporation, Kennet Square, Pa. The unit is powered by a 4-cylinder Hercules gasoline power unit, Model ZXB, 2⅝ in. bore and 3 in. stroke, manufactured by Hercules Motors Corporation, Canton, O. The spreader can be mounted on a truck chassis or it may be mounted in a truck body from which it may be easily removed to leave the truck free for other work. It has a 6-yard bin equipped with a large screw conveyor and a spreader of the spinner disc type which will spread a width of 9 to 15 ft. One

man can easily control the entire operation. The Hercules power unit is mounted on the spreader frame and furnishes the complete power needed to operate the spreader. It drives the screw conveyor which permits the use of dry or damp sand and



Good Roads Spreader, Model Y-186

which eliminates the need for an extra man. It also furnishes the power for the disc type spreader. Independent power for the spreader allows positive control of spread at any truck speed. The entire unit is controlled by the truck driver from the cab.

Snyder Appointed Sales Representative for Milburn

The Alexander Milburn Co., 1493 West Baltimore St., Baltimore, Md., manufacturers of spray finishing equipment and cutting and welding apparatus, announce the appointment of Frank P. Snyder as sales representative in Detroit. Mr. Snyder was formerly sales engineer for the De Vilbiss Co., and has wide experience in the design, sales and installation of spray finishing equipment.

New 200 H.P. Murphy Diesel Engine

A new 200 H.P. diesel engine, known as ME-650, has been announced by the Murphy Diesel Co., Ltd., Milwaukee, Wis. The design of this engine conforms to that of the standard Murphy diesel Model ME which has proved so successful in service. Injection is direct into a plain symmetrical combustion chamber. Injector and fuel pump are combined in one unit which is easily and quickly removed and replaced. There are no high pressure fuel lines and injectors cannot become air bound. Special care has been taken to assure cool operation and pistons are oil cooled under pressure. Four valves are provided for each cylinder. Should the oil pressure drop below a fixed minimum pressure, the engine automatically shuts itself off. Control is through a single lever which permits easy and simple toggling-in for remote control. Starting is accomplished by a standard 24-volt starter. The design of the new Murphy engine is simple and compact, and all parts are easily accessible. The ME-650 can be had either as a bare engine or with radiator and full enclosure. Skids, outboard bearings, and direct connected generator units are also available.

Marks Hardened Steels

A new, low-priced electric etcher that marks iron and steel and their alloys, including hardened steels, legibly, permanently, easily and economically, is another development of the Ideal Commutator Dresser Co., 1372 Park Ave., Sycamore, Ill. This etcher is used in the same manner as a pencil and engraves names, sizes, models, numbers or other important data on smooth surfaced parts, tools, dies, saws, plates, gears, etc. The complete unit includes a handpiece and alloy point, transformer with three taps, special primary cord with tap-changing switch, secondary leads of No. 8 wire and a work plate. Weight 12 lbs.

Three etching speeds are controlled by a switch on the primary cord. Depth of the etching is governed by the speed at which the point is moved over the metal. Standard unit is for 110 volt, 60 cycle service. Also available for other alternating current circuits.

WITH THE MANUFACTURERS

Motor Equipment Co. New Distributor for Blaw-Knox

The Blaw-Knox Co., Pittsburgh, Pa., announces that exclusive selling rights on Blaw-Knox construction equipment and clamshell buckets in the entire State of New Mexico, and in the twenty-one western counties of Texas, have been granted to the Motor Equipment Co., Albuquerque, N. M.

Spray Painting Training School

The DeVilbiss Company has announced the schedule of its training school for the first half of 1939. This school is open to industrial painters, master painters, automobile refinishers, and all others interested in learning the technique of spray-painting, and the use and care of spray-painting equipment. The training period lasts for one week. Classes will start on the following dates: March 13, April 17, May 15, and June 5. Special rates in Toledo hotels and boarding houses near the plant have been secured for men attending the school. Complete information may be obtained by writing The DeVilbiss Company, Toledo, Ohio.

Gamble Appointed Secretary Ohio Paving Brick Mfrs. Assn.

The previous announcement that Mr. Victor K. Gamble was appointed Secretary and Chief Engineer of the Ohio Paving Brick Manufacturers Association, which is the Ohio Region of the National Paving Brick Association, is in error. Mr. Gamble became Secretary on Dec. 15th, but was not appointed the Chief Engineer of the Ohio Association.

Bode-Finn to Represent Ransome

The Ransome Concrete Machinery Co., Dunellen, N. J., have just closed with the well known Cincinnati equipment agents —Bode-Finn Equipment Co., Inc., 1654 Central Ave., to represent them in that territory. They will handle the complete Ransome line consisting of pavers, central plant mixers, building mixers (both small and large) plaster and mortar mixers, bituminous mixers, etc.

ADVERTISERS' INDEX

The Dash (—) Indicates that the Advertisement Does Not Appear in This Issue

*Advertisers with * are represented in the 1938 edition of Powers' Road and Street Catalog and Data Book. Please refer to it for additional information on any of their products.

CLEARING HOUSE

Texas Co. Combines Dallas and Houston Asphalt Sales Offices

The Dallas office and the Houston office of the Asphalt Sales Department, The Texas Co., have been combined and the Dallas office closed. Mr. A. D. Stivers of the Dallas office has been transferred to New York and his duties in Texas assumed by L. W. Kemp, The Texas Company Building, Houston.

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New International Harvester Snow Removal and Earth Moving Sound Pictures

"Snow Fighters" is the title of a one-reel dramatized sound motion picture just released by the International Harvester Co. It pictures an organized plan for snow-moving operations in which municipal, township, county, and highway officials cooperate in efficient use of equipment to keep traffic moving. Motor trucks, wheel tractors, road maintainers, and crawler tractors, all equipped for snow moving, are shown working the particular type of road or highway for which each is adapted. The International Harvester Co. has also recently produced and released a one-reel sound motion picture entitled "Earth Moving," which portrays the different types of equipment used in a variety of typical earth-moving operations. Highway construction and maintenance; land clearing; oil field jobs; trail building; gravel, sand and clay-pit work; railroad right-of-way maintenance; and other operations are pictured to show the wide adaptation of crawler-type tractors, road maintainers, wheel tractors, and motor trucks to dirt-moving activities. Prints of either of these films may be borrowed free of charge by communicating with the International Harvester Company, 180 North Michigan Ave., Chicago, Ill.

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Michael Riesner, Worthington Consultant, Passes

Michael Riesner, Consulting Engineer for Worthington Pump and Machinery Corporation, and an outstanding authority in the field of air and gas compression, died suddenly at his home in Buffalo, New York, on December 12. A member of the Worthington organization since 1892, Mr. Riesner served the corporation as chief engineer of its Cincinnati works for 20 years. In this capacity he was responsible for several outstanding developments, including a complete line of compressors ranging from the very low capacities up to 36,000 cu. ft. per minute. He designed and developed many of the special units used today by the United States Government as standard equipment. His work brought him recognition in the Chemical and Compressed Gas industries as an expert designer of compression machinery, especially for compressing gases to very high pressures. Recently honored by Worthington Pump and Machinery Corporation for long and outstanding service, Mr. Riesner is mourned by all who knew him.

B. W. Druckenmiller Becomes General Sales Manager of Pennsylvania-Dixie Cement Corporation

Walter S. Wing, Vice-President and Director of Sales, of the Pennsylvania-Dixie Cement Corporation has announced the appointment of B. W. Druckenmiller as general sales manager, with headquarters at 60 East 42nd St., New York City, effective Jan. 1, 1939. Mr. Druckenmiller started work in the cement industry over 25 years ago and has been actively engaged in sales work for the greater part of this time. He has wide acquaintanceships in the construction industry.

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Neil C. Hurley, Jr., Elected Vice-President of Independent Pneumatic Tool Co.

N. C. Hurley, Jr.

Mr. Neil C. Hurley, Jr., was elected a Vice President of the Independent Pneumatic Tool Company at a special meeting of the board of directors Jan. 10. Mr. Hurley has been secretary of the company for the past four years. He joined the company in 1932 upon graduation from the University of Notre Dame and has been active in the direction of sales for the company's electric tool division.

Pictures tell story...

OF NEW TYPE CENTER CURBING

Scored surface of white concrete improves visibility...makes night and bad weather driving safer for New Jersey motorists.

Ready to start laying the second half of new type white concrete center curbing on New Jersey Route 26.

Applying white concrete to unfinished half of curbing, with part of the gray concrete base still showing.

With the white concrete placed, the next step is scoring the sides.

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Smoothing off the lower edge. Ridge is handled the same way.

Scoring the curved end with horizontal lines instead of vertical lines seen on the sides.

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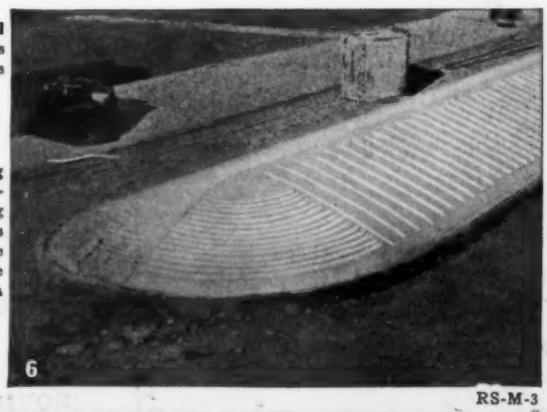
Finished curbing assures improved visibility and safer driving for the motorist. It was constructed under the supervision of the State of New Jersey as a W. P. A. project.



THE TYPE of center curbing you see under construction here does more than divide traffic. It has the high, permanent visibility which white concrete assures. But this surface is scored. As a result, it improves visibility. It helps to eliminate a hazard of driving at night and on rainy, foggy days.

This white concrete curbing made with Atlas White portland cement is produced on the job and then scored. Another new type is pre-cast and ribbed—then brought to the job in sections for quick installation.

Both types of white concrete curbing (and markers) made with Atlas White cement have proved their permanence and economy in use and their effectiveness in reducing accidents. They need no maintenance—no repainting, repairing or replacing. They pay for themselves in long service. They help to keep traffic running safely and smoothly. Universal Atlas Cement (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

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